City of Quesnel

Water & Sewer Servicing Study

URBAN systems

February 2013 / 1190.0146.01

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1.0 Introduction

1.1 Study Background

The City of Quesnel owns and operates the water and sanitary utilities that services residential, commercial and industrial properties within City limits. A portion of a community sanitary collection system in South Quesnel within City limits is owned and maintained by the Cariboo Regional District. Although the majority of residents are serviced, pockets of areas exist within city limits that do not have water and sanitary service.

In the past, there has been interest by the municipality and owners of some unserviced properties to connect to the municipal system. In response, a number of studies and cost estimates have been completed over the last 15 years for utility extensions to some of the areas that lack municipal water and/or sanitary service.

The City is now interested in compiling all past information and completing new cost estimates in one document to gain a better understanding of the overall cost to service all existing unserviced, developed areas within city limits. This information will aid in property owners to consider the cost for servicing their properties and to help the City with future capital planning.

1.2 Study Objectives

The objective of this study is to provide the City of Quesnel with cost estimates for infrastructure extensions to provide water and sanitary service to areas within city limits that do not have those services.

2.0 Study Area

2.1 Unserviced Areas within City Boundaries and Areas Included in Study

Figure 2.1 was provided by the City of Quesnel and illustrates areas that receive (i) both water and sewer service, (ii) either water or sewer service or (iii) neither service.

Based on preliminary discussions with the City, and knowledge of the area, certain areas were not considered in this study. Areas not included in this study are shown in Figure 2.2. These areas include;

Large Undeveloped Lots in West Quesnel

Part of the area in West Quesnel is not included as it is undeveloped land, and municipal connections will be paid for in the future by the land developer.

Three Mile Flats East

The area east of Three Mile Flats was not included in the study as it is not developed and there is extremely low potential for development in that area.

Large Undeveloped Lots in South Hills

Areas undeveloped in South Hills were not included in the study, and municipal connections will be paid for in the future by the land developer.

Large Undeveloped Lots Near Gook Road/Dragon Lake

The area on the west side of Gook Road was not included, as it is not yet developed, and municipal connections will be paid for in the future by the land developer.

Panorama Ridge

Panorama Ridge was not included in this study, as access to this subdivision is through the Cariboo Regional District.

Plywood Road

The Quesnel Plywood Plant is operated on this land, and was not included in this study, as it is major industry that operates without the need for City water or sanitary service.

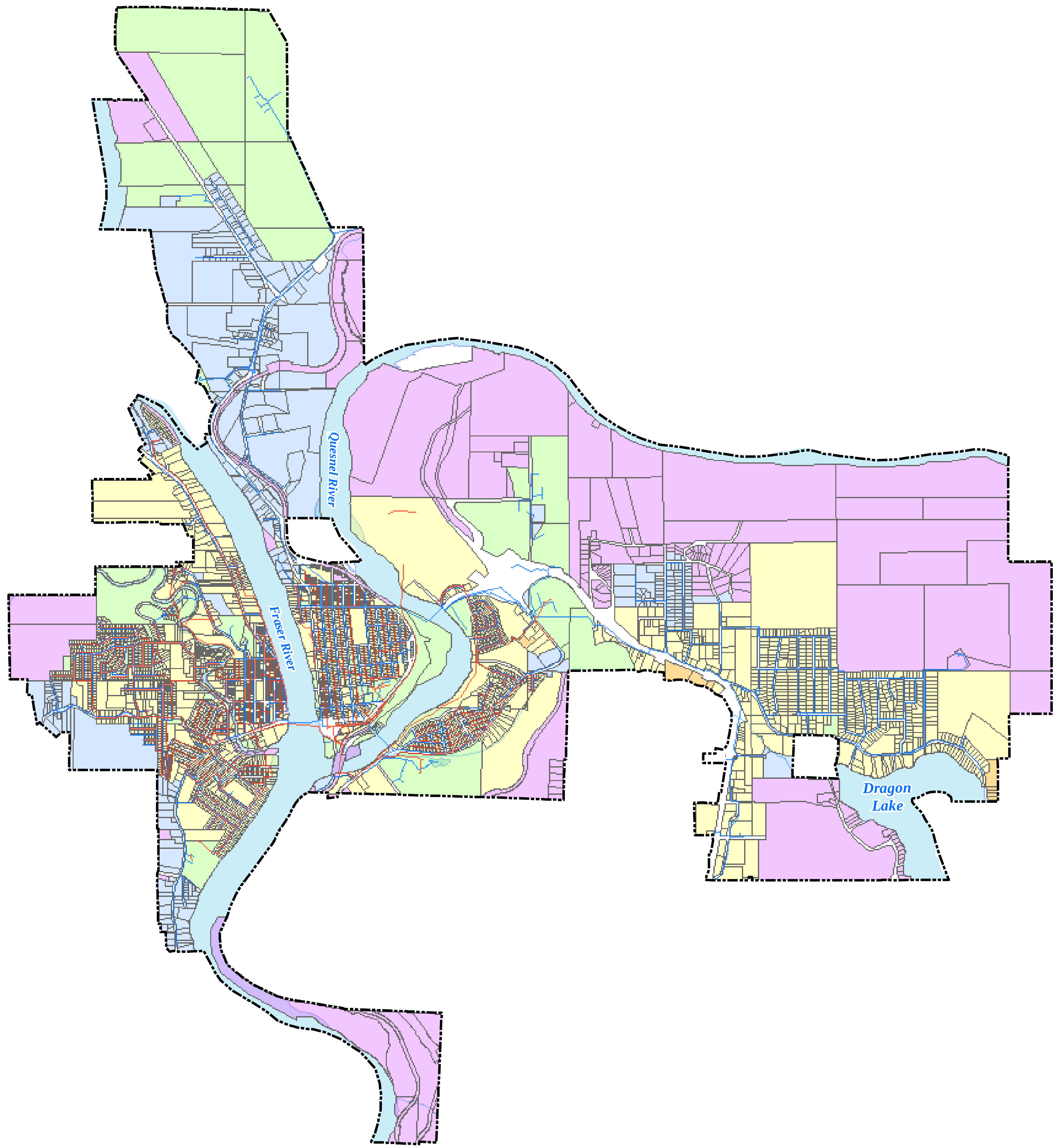
URBAN systems

WATER AND SANITARY SERVICING INVESTIGATION

DATE: SEPTEMBER 2012

CITY OF QUESNEL

1:45,000



Legend

- Municipal Boundary
- Sanitary Main
- Water Main
- Water and Sewer Service
- Water Only
- Sewer Only
- No Services
- Parks/Facilities

0 0.5 1 2 Km

SOURCE:
Base data provided by the City of Quesnel.

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CURRENT WATER AND SANITARY SERVICING

FIGURE

2.1

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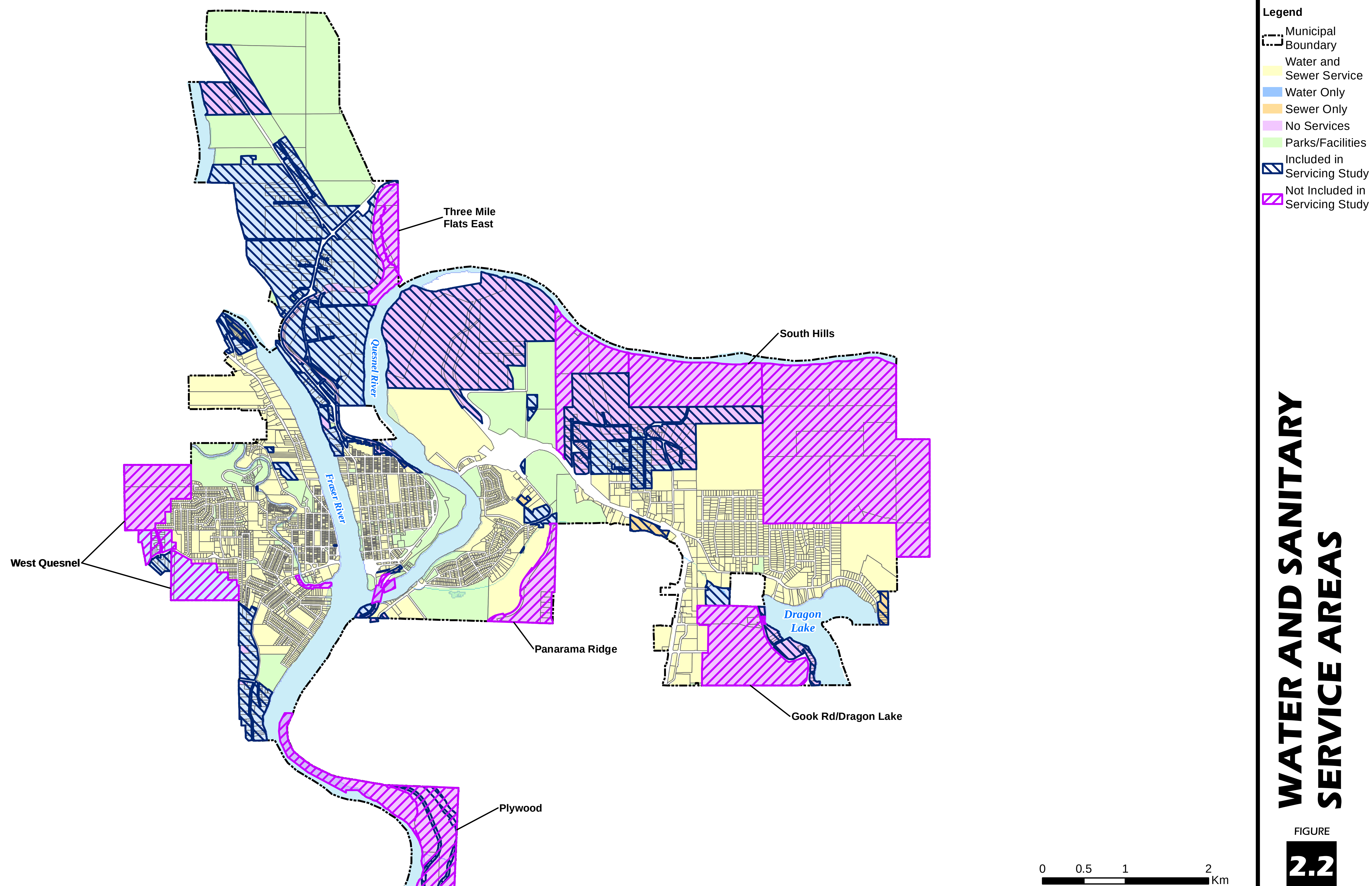
WATER AND SANITARY SERVICING INVESTIGATION

DATE: SEPTEMBER 2012

CITY OF QUESNEL

1:45,000



SOURCE:
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WATER AND SANITARY SERVICE AREAS

FIGURE

2.2

2.2 Study Areas – Water and Sewer Service

Areas that currently are not connected to a sanitary sewer system that are reviewed in this study are shown in Figure 2.3. Figure 2.4 identifies the areas reviewed in this study without municipal water service.

Figure 2.3 highlights areas that are not currently connected to the municipal sewer system. Servicing concept and cost estimates have been divided into 15 areas and are summarized in Table 2.1;

Table 2.1 – Sewer Service Areas Breakdown

Area Description	Area Name	# of Parcels
A	Two Mile and Three Mile Flats	86
B	Walkem Street North	9
C	Westland Close	28
D	Richards Road	31
E	DVC	88
G	Woodridge Road	7
F	CPP/Landfill	7
H	Gook Road/Dragon Lake	23
I	North Star Road	4
K	West Fraser Road	50
L	Abbott Drive	6
M	Baker Drive	2
N	Mills Road	10
P	Larch Avenue	1
Q	Johnston Avenue	6

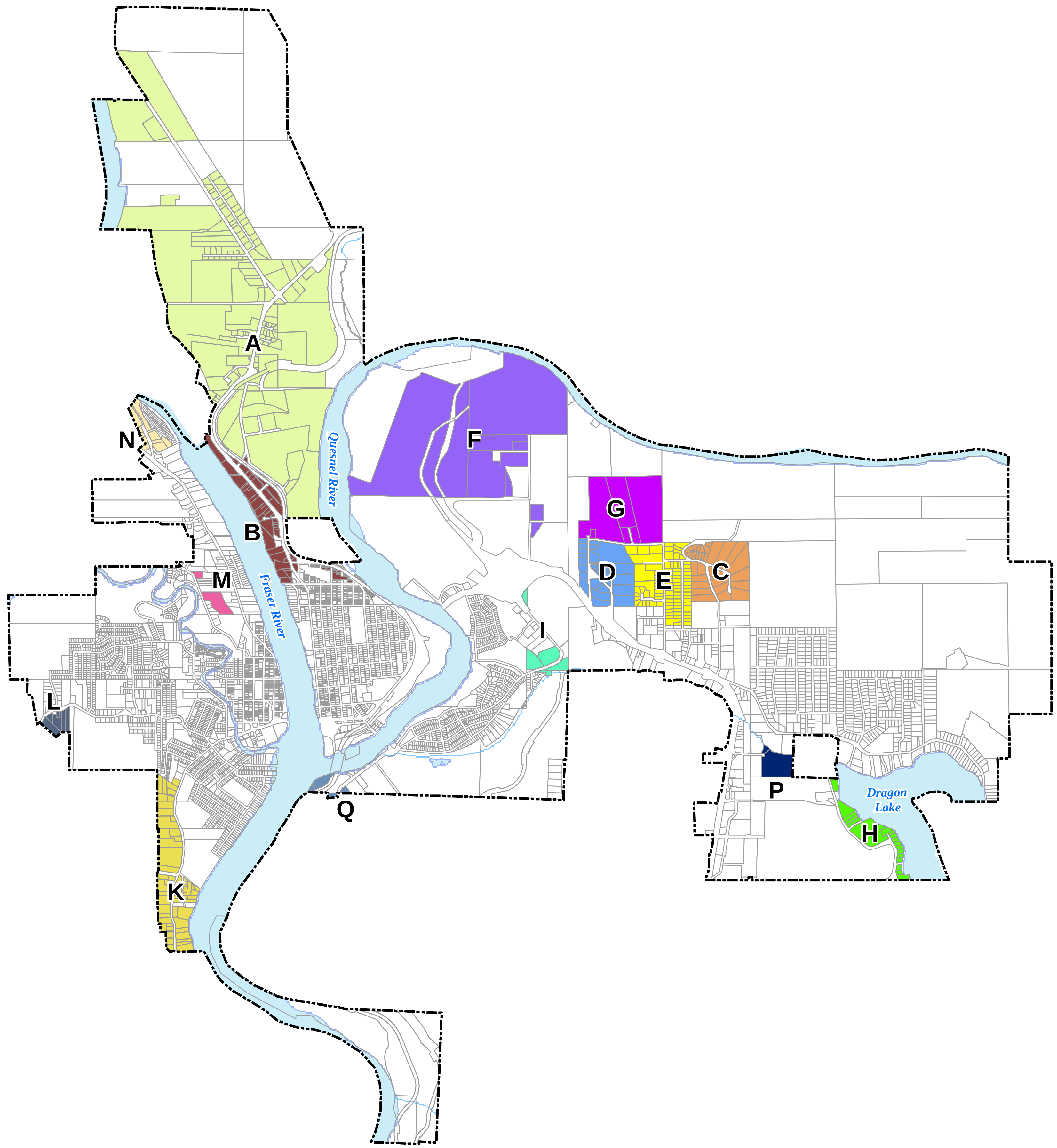
URBAN systems

WATER AND SANITARY SERVICING STUDY

DATE: SEPTEMBER 2012

CITY OF QUESNEL

1:45,000



Legend

- Municipal Boundary
- A - Two & Three Mile Flats
- B - Walken Street North
- C - Westland Close
- D - Richards Road
- E - DVC
- F - CPP/Landfill
- G - Woodridge Road
- H - Gook Road/ Dragon Lake
- I - Northstar Road
- K - West Fraser Road
- L - Abbott Drive
- M - Baker Drive
- N - Mills Road
- P - Larch Avenue
- Q - Johnston Avenue

STUDY AREAS WITHOUT MUNICIPAL SEWER SERVICE

FIGURE

2.3

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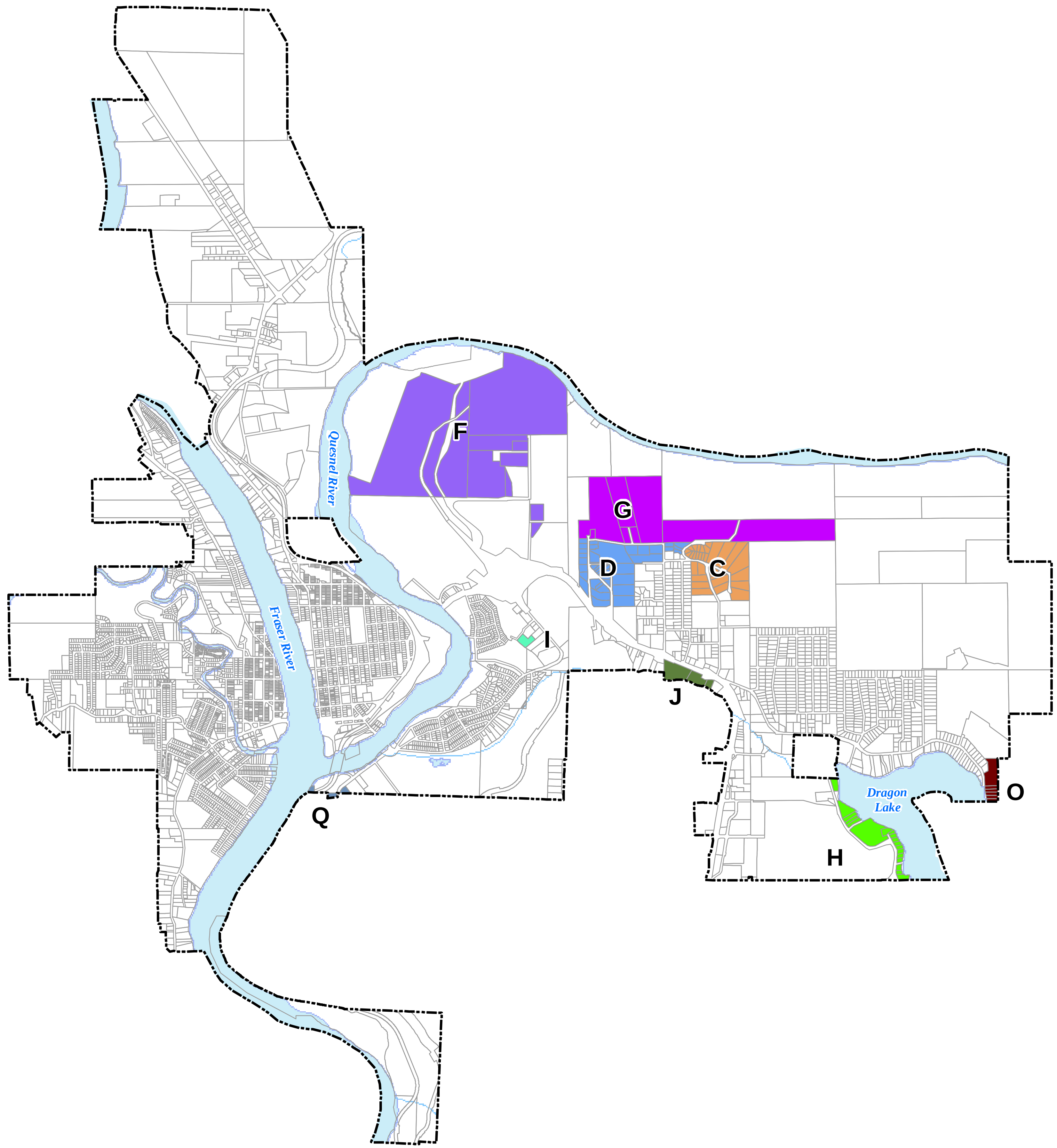
WATER AND SANITARY SERVICING STUDY

DATE: SEPTEMBER 2012

CITY OF QUESNEL

1:45,000



Legend

Municipal Boundary

Water Service Areas

- C - Westland Close
- D - Richards Road
- F - CPP/Landfill
- G - Woodrige Road
- H - Gook Road/ Dragon Lake
- I - Northstar Road
- J - Dragon Hill Road
- O - Quesnel Hydraulic Road
- Q - Johnston Avenue

0 0.5 1 2 Km

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STUDY AREAS WITHOUT MUNICIPAL WATER SERVICE

FIGURE

2.4

Figure 2.4 highlights areas that are not currently connected to the municipal water system. Servicing concept and cost estimates have been divided into 9 areas and are summarized in Table 2.2;

Table 2.2 – Water Service Areas Breakdown

Area Description	Area Name	# of Parcels
C	Westland Close	34
D	Richards Road	28
F	CPP/Landfill	7
G	Woodridge Road	11
H	Gook Road/Dragon Lake	23
I	North Star Road	1
J	Dragon Hill Road	4
O	Quesnel Hydraulic Road	6
R	Johnston Avenue	2

3.0 Existing Studies and Cost Estimates

Cost estimates and studies have been completed for several of the areas outlined in Section 2. Where existing cost estimates have been completed, they were reviewed and updated. The existing studies that were reviewed as part of this study are as follows;

- Red Bluff/Dragon Lake/South Hills Water Supply, completed by Urban Systems Ltd in 1998. Cost estimates were updated in 2001 for a Grant Application.
- 2 & 3 Mile Flat Sewer Study, completed by Urban Systems Ltd. in 2000.
- South Hills Sewer Extension Feasibility Study, completed by Urban Systems Ltd. in 2001.
- Cariboo Pulp and Paper Water Supply, completed by Urban Systems Ltd. in 2002.
- South Hills Sewer Extension Preliminary Design, completed by Urban Systems Ltd. in 2003.
- Extension of Municipal Water Service Feasibility Study, completed by Urban Systems in February 2005.
- Westland Close Water Servicing Cost Estimate Update for Public Meeting, completed by Urban Systems Ltd. in 2009.

All background information related to these studies including, reports, letters, figures and cost estimates are included in Appendix A.

4.0 2012 Cost Estimates

Servicing concepts and a breakdown of new and updated cost estimates are included in Appendix B. It is noted that where existing cost estimates existed, they were simply updated using 2012 quantities and rates, they were not re-formatted. Consequently the format is not consistent throughout. Table 4.1 and 4.2 summarize the cost estimate for each area for sewer and water service.

Table 4.1 Sewer Servicing Cost Estimate

Area	Area Name	Existing Cost Estimate	2012 Cost Estimate
A	Two Mile and Three Mile Flats	Yes - 2000	$ 6,360,000
B	Walkem Street North	Yes - 2000	$ 196,000
D + G	Richards/Woodridge Road	No	$ 832,000
C + E	South Hills (Westland+ Oval+DVC)	Yes-2003	$ 2,275,000
F	CPP/Landfill	No	$ 649,000
H	Gook Road/Dragon Lake	No	$ 406,000
I	North Star Road	No	$ 109,000
K	West Fraser Road	No	$ 1,206,000
L	Abbott Drive	No	$ 163,000
M	Baker Drive	No	$ 64,000
N	Mills Road	No	$ 290,000
P	Larch Avenue	No	$ 39,000
Q	Johnston Avenue	No	$ 125,000

Table 4.2 Water Servicing Cost Estimate

Area Description	Area Name	Existing Cost Estimate	2012 Cost Estimate
C	Westland Close	Yes-2009	$ 1,063,000
D + G	Richards Road/Woodridge Road	Yes - 2005	$ 1,691,000
F	CPP/Landfill	Yes-2002	$ 1,324,000
H	Gook Road/Dragon Lake	Yes-2001	$ 1,273,000
I	North Star Road	No	$ 13,000
J	Dragon Hill Road	No	$ 358,000
O	Quesnel Hydraulic Road	Yes - 2001	$ 175,000
R	Johnston Avenue	No	$ 96,000

5.0 Financial Analysis

An important aspect of the cost estimates provided above is how the costs will be transferred onto residents or businesses if services are provided to those areas. For comparison purposes, two scenarios have been considered; a cost per lot based on each area, and a cost per lot based on a community-wide, approach whereby al the service area costs are combined.

A third cost sharing option that could be assessed is a cost based on the frontage length or a deemed frontage length. This was not included in this study as it difficult to assess at a high level and summarize, since each property would result in a different cost. However, the option of utilizing a frontage approach could be considered if servicing extensions are to be examined in more detail.

5.1 Cost per Lot Scenario 1 – Separate by Service Areas

Scenario 1 considers the cost to service each area separately, with no cost sharing across the distinct service areas. Table 5.1 and 5.2 summarize the cost per lot for each area for sewer and water services.

Table 5.1: Cost Per Lot Scenario 1 – Sewer Service

Area Description	Area Name	2012 Cost Estimate	Total (Commuted) Cost / Lot	Annual Cost Per Lot [(1)]
A	Two Mile and Three Mile Flats	$ 6,360,000	$ 74,000	$ 5,100
B	Walkem Street North	$ 196,000	$ 22,000	$ 1,500
D + G	Richards/Woodridge Road	$ 832,000	$ 22,000	$ 1,500
C+E	South Hills (Westland+ Oval+DVC)	$ 2,275,000	$ 20,000	$ 1,400
F	CPP/Landfill	$ 649,000	$ 93,000	$ 6,400
H	Gook Road/Dragon Lake	$ 406,000	$ 18,000	$ 1,200
I	North Star Road	$ 109,000	$ 27,000	$ 1,900
K	West Fraser Road	$ 1,206,000	$ 24,000	$ 1,600
L	Abbott Drive	$ 163,000	$ 27,000	$ 1,900
M	Baker Drive	$ 64,000	$ 32,000	$ 2,200
N	Mills Road	$ 290,000	$ 29,000	$ 2,000
P	Larch Avenue	$ 39,000	$ 39,000	$ 2,700
Q	Johnston Avenue	$ 125,000	$ 21,000	$ 1,400

Note (1): Assumed as 20 year loan from Municipal Finance Authority at 3.5% interest rate

Table 5.2: Cost Per Lot Scenario 1 – Water Service

Area Description	Area Name	2012 Cost Estimate	Cost /Lot	Cost/Lot inc. Major Inf. Contribution	Annual Cost Per Lot (1)
C	Westland Close	$ 1,063,000	$ 31,000	$ 35,455	$ 2,500
D + G	Richards/Woodridge Road	$ 1,691,000	$ 43,000	$ 47,455	$ 3,300
F	CPP/Landfill	$ 1,324,000	$ 189,000	N/A	$ 13,000
H	Gook Road/Dragon Lake	$ 1,273,000	$ 55,000	$ 59,455	$ 4,200
I	North Star Road	$ 13,000	$ 13,000	N/A	$ 900
J	Dragon Hill Road	$ 358,000	$ 90,000	$ 94,455	$ 6.600
O	Quesnel Hydraulic Road	$ 175,000	$ 29,000	$ 33,455	$ 2,400
R	Johnston Avenue	$ 96,000	$ 48,000	$ 48,000	$ 3,700

Note (1): Assumed as 20 year loan from Municipal Finance Authority at 3.5% interest rate and, for lots in South Quesnel an annual major infrastructure contribution of $400 per year for 20 years.

$4,455 per lot has been added in calculating the cost estimate for providing water service for lots located in South Quesnel. This amount is associated with construction of the 250 mm diameter major water main loop shown the following figure. It is understood that the City is interested in refining the alignment of this trunk main loop as part of the overall development of the Woodridge Road area.

Figure 5.3: Conceptual Layout of 250 mm Trunk Main

The extents of the major system loop include:

- Construct new 250 mm diameter main along Valhalla Rd., Jason Pl., Woodridge Rd. and the north end of Racing Rd.
  - Cost assigned to $4,455/lot charge relate to upsizing the pipe from 200 mm to 250 mm diameter
- Construct new 250 mm diameter main on Westland Rd. (Racing Rd. to Dennis Rd.)
  - Full cost assigned to $4,455/lot charge as this involves twinning an existing pipe
- Upsize new 250 mm diameter main on Westland Rd. from Dennis Rd. to Valhalla Lodge
  - Cost assigned to $4,455/lot charge relate to upsizing the pipe from 200 mm to 250 mm
- Construct new 250 mm diameter main from Vahalla Lodge to Britton Rod. Along Richardson Rd.
  - Already constructed – no cost included in$4,455/lot charge
- 250 mm dia. main in South Hills Area (Quesnel Hydraulic Rd. to Coach Rd.)
  - Full cost assigned to $4,455/lot charge as this involves twinning existing pipes

It is understood that there is a strong interest for the installation of water services along Racing Road and Woodridge Road. This would involve connecting to the existing water system at the intersection of Westland Road and Racing Road and then extending a main up to and along Woodridge Road as far as the gas transmission main (approximately 530 metres). The estimated cost to undertake this work is $ 441,000 ($37,000 per lot), not including the major infrastructure contribution. The cost is fairly conservative and based on limited site information, and would likely decrease slightly with additional study. It should also be noted that the proposed water main for the Richards/Woodridge Road area is also conceptual and if the City is planning on phasing servicing throughout the area, an overall plan should be developed to ensure that the most beneficial design for the City.

5.2 Cost per Lot Scenario 2 - Service Areas Combined

Scenario 2 is based on the overall cost to service all unserviced areas, divided by the number of unserviced lots. Table 5.3 summarizes the cost per lot for Scenario 2.

Table 5.3: Cost Per Lot Scenario 2

Service Type	Total Cost Estimate	Total # of Lots	Cost /Lot	Annual Cost Per Lot (1)
Water	$ 5,953,000	116	$ 52,000	$ 3,600
Sewer	$ 12,714,000	350	$ 36,000	$ 2,500

Note (1): Assumed as 20 year loan from Municipal Finance Authority at 3.5% interest rate

5.3 Additional Costs

It is important to note that the costs in this report section relate only to the cost of the capital works on public property to bring service to the property lines of the individual properties. The cost to install the services across private property, the utility Connection Charges and all annual water and/or sanitary utility charges would also need to be considered by the property owners when deciding about investing in utility connections.

5.4 Discussion

Considerations should be made when evaluating which cost per lot scenario would be applied in the future.

Although Scenario 2, whereby all service areas are amalgamated to provide a City-wide cost per lot, can be seen as a simpler cost sharing option, there could be challenges associated with this method.

When costs broken up by area as in Scenario 1, it is obvious which areas are more cost prohibitive to service. For example, servicing CPP and the landfill area results in the highest cost per lot for both sewer and water servicing. Including this area in an overall combined cost per lot does not result in equitable cost sharing for a residence that is in very close proximity to an existing water main in a different area.

Another example is the impact of topography on providing sanitary service. One area may require a lift station, which would result in a higher cost than an area where sewer service can be provided by gravity.

Finally, another advantage of considering costs as separate areas is that each area can be considered separately based on when and if the area's property owners would like to be serviced. Due to inflation in construction costs, if areas are interested in connecting years apart from each other than the one cost for all areas approach would be more difficult to manage financially.

6.0 Recommendations for Moving Forward

If the City is interested in moving forward with the connection of some or all of the areas discussed above, the following is recommended;

- Make this document public to open (or re-open) the conversation with residents to arm them with information on the associated costs of connecting to the municipal system.

- Host an open house for owners of unserviced properties to allow residents to start considering as a group whether they desire to be connected to the system. The City may wish to wait and not complete an open house for the entire community, but rather have individual meetings related to the individual areas. It is recommended that those individual meetings only be conducted if they are first prompted by the property owners within the areas as it does not seem efficient to meet with an area if they are not interested in making the monetary investment in making utility connections.

- If there is a desire to move forward with connecting an area to the system, complete a preliminary design to refine the cost estimates.

- The cost to service the properties should be funded through a Local Area Service funding arrangement, whereby the City manages the financing and property owners each pay their share of the cost. Entering into a Local Area Service agreement can involve either a petition or a counter petition process. It is recommended that the City employ a petition process. In this manner it will help to minimize the perspective that the City is forcing the extension of services on the property owners. The City would facilitate the steps required to construct and pay for the works only if there is sufficient support by the private property owners.

APPENDIX A

Existing Servicing Concepts and Cost Estimates

URBAN systems

A Report to

CARIBOO REGIONAL DISTRICT
CITY OF QUESNEL

Red Bluff/Dragon Lake/South Hills Water Supply

URBAN SYSTEMS

April 14, 1998
6047509.1
980325chrpt.doc

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April 14, 1998

Job Number: 6047509.1 C1

City of Quesnel
405 Barlow Avenue
Quesnel, BC
V2J 2C3

Attention: Mr. Doug Ruttan, Administrator

Dear Sirs:

Reference: Red Bluff Water Study

Accompanying this letter are 15 copies of our report on the infrastructure required for the supply and distribution of water to Red Bluff, Dragon Lake and South Hills. Our report expands on the concepts presented in our memorandum of September 8, 1996 and confirms the estimated cost for both the supply and distribution systems.

We thank you for continuing to use our services for this study and remain available to assist in preparing grant applications and proceeding with implementation of the water system expansion.

Please call us if we can be of further assistance.

Yours truly,

URBAN SYSTEMS LTD.

David Kirsop, P.Eng.
Senior Engineer

/kl DOC: 980414dktr.doc
Encl.

c: R. Hein – Cariboo Regional District

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T: 403.291.1193
F: 403.291.1374

☐ 203-625 FRONT STREET
NELSON, BC
V1L 4B6
T: 250.352.9774
F: 250.352.5322

☐ 315-9900 100TH AVENUE
FORT ST. JOHN, BC
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F: 250.785.9691

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LIST OF DRAWINGS

Executive Summary

This report confirms the feasibility of extending water service from the City of Quesnel out to the area of Red Bluff, South Hills and Dragon Lake. The extent of the study area is shown in Figure No. 3.1.

The population within the study area is presently estimated to be 6,500 and is expected to grow to 11,200 by the year 2020. Water supply to meet the present and future needs of the community will be derived from new wells situated along the south bank of the Quesnel River. Figure No. 5.3 illustrates the proposed water supply system.

Figure No. 6.2 illustrates the proposed pipe locations and sizes for both the supply and distribution system. The system is designed in compliance to requirements of the City of Quesnel Design Criteria to meet present and future needs.

The cost of the initial supply system is estimated to be $7,916,000 this is inclusive of:

- trunk water mains;
- first two wells;
- first cell of the proposed reservoir; and
- construction of the booster pump station at Alex Fraser Park.

Future upgrades to the supply system will be implemented as demands warrant and will consist of:

- two additional wells;
- installation of two additional pumps at the booster pump station; and
- construction of the second reservoir cell.

The cost for future upgrades to the water supply system is estimated to be $1,688,000.

The cost for the distribution system is estimated to be $24,251,000.

All of the above costs are inclusive of engineering fees and a twenty percent contingency allowance.

1. Introduction

The City of Quesnel and the Cariboo Regional District have jointly commissioned this study to determine the feasibility of extending the City water system southward to provide water service to the communities of Red Bluff, South Hills and Dragon Lake. The extent of the study area is shown in Figure No. 3.1.

Within the community of South Hills, water supply and distribution is provided by a private utility known as South Hill Developments Ltd. This system serves approximately 1400 residents in 440homes. This water utility was evaluated and reported on in studies undertaken by T.R. Underwood Engineering, in July 1995, and Civic Engineering Services Ltd. in October 1990.

These studies concluded:

- existing water mains were in reasonable condition;
- improvements to the system of existing water mains are required to meet fire flow requirements of the Fire Underwriters Survey Guide to Recommended Practice;
- the present system of wells is incapable of providing water in sufficient quantity to comply with standards of supply for rural water systems; and
- encrustation of service lines as a result of poor water quality was resulting in extreme loss of service pressure at individual residences.

Efforts by South Hill Developments Ltd. to locate suitable new wells as a long term water supply have been unsuccessful.

The remainder of the Red Bluff / Dragon Lake area is serviced from individual wells. The majority of these are shallow wells for which detailed records are unavailable however, anecdotal evidence suggests many residences experience problems with water quality and seasonal fluctuations in available quantity.

Possible sources of water supply for the Red Bluff / Dragon Lake / South Hills Area are considered in reports prepared by Strong Lamb & Nelson (1975), Willis Cunliffe & Tait (1977) and Civic Engineering (1990). In all of the above reports there is common consensus that there

is no evidence of a strong aquifer within the study area which could be relied upon for long term water supply. If ground water were to be considered a supply option then an extensive program of test drilling and geotechnical investigation would be required to determine if such an option were feasible.

In comparison, the City of Quesnel is presently supplied from 4 wells drilled in close proximity to the Fraser River. These wells are capable of producing a total of 250 l/s (3330 Igpm). A fifth well, situated adjacent to the Quesnel River on the south bank, produced good quality water but was eventually abandoned due to sanding problems, the development of new wells on the south bank of the Quesnel River is a reasonable assumption in planning future supply works.

For the purpose of this report we have assumed water will come from the continued development of wells along the lower banks of the Fraser and Quesnel Rivers.

The extension of the City boundary to encompass the areas of Red Bluff, South Hills and Dragon Lake, as defined in this report, would allow for development of a secure water system capable of meeting both the immediate and long term requirements of each community. This report documents the works required to achieve this goal and the associated costs.

2. Design Criteria

2.1 Domestic Consumption

Well records for the City of Quesnel show the maximum day demand to be 13,343,095 liters, approximately 14 percent of this consumption is attributed to industrial users. The remaining 11,483,660 litres is attributable to the serviced population of 8,500 persons. Based on these records the recorded maximum day demand is 1,350 litres per capita day (ℓpcd).

Peak hour demand is estimated to be 2,025 ℓpcd using a peaking factor of 1.5 between maximum day and peak hour flow. This ratio is consistent with the ratios contained in the City of Quesnel Design Guidelines.

The minimum allowable service pressure for domestic service is 265 KPa. The maximum allowable service pressure in the distribution system is 690 KPa provided each house is equipped with individual pressure reducing valves, otherwise the maximum allowable pressure is 540 KPa. As the top water level of the South Hill Reservoir will be at least 663 metres, buildings below an elevation of 609 metres will have to be equipped with individual pressure reducing valves.

The City of Quesnel Design Guidelines do not contain values for providing daily water service to industrial/commercial lands. As a large percentage of land fronting Highway 97 falls into this category we have used the following consumption figures, derived from a review of guidelines in use in other communities:

Maximum Day Demand	45,000 ℓ/ha/day
Peak Hour Demand	60,000 ℓ/ha/day

2.2 Fire Protection

The City requires developers to comply to Fire Underwriter's Survey (FUS) requirements for the provision of fire protection services. FUS stipulates minimum hydrant flows which must be achieved during periods of Maximum Day Demand at a minimum residual pressure of 140 KPa. The FUS guidelines are specific to: type of building

construction, flammability of building contents, separation from other buildings, internal fire protection systems and the number of building storeys. Following below is a summary of the fire flow criteria used for this report. The values which follow represent a reasonable balance between the requirements outlined in the FUS guidelines and what is provided in municipalities of similar population size. We have recommended values which make it possible for developers to construct facilities in compliance to FUS guidelines.

Fire flows modelled were:

residential	75 ℓ/s
school sites	190 ℓ/s
commercial sites	220 ℓ/s

3. OCP and Zoning Bylaw

The Quesnel Fringe Area Official Community Plan (OCP) provides guidelines for the development of the areas immediately outside of the City of Quesnel boundaries. Red Bluff, Dragon Lake and South Hills all are within the fringe boundary. Permitted uses include detached single family dwellings, mobile homes and multi-family dwellings. Other types acceptable are commercial and industrial development located in a strip along the Cariboo Highway. Existing non-conforming uses include a few light industrial areas located in the residential zone.

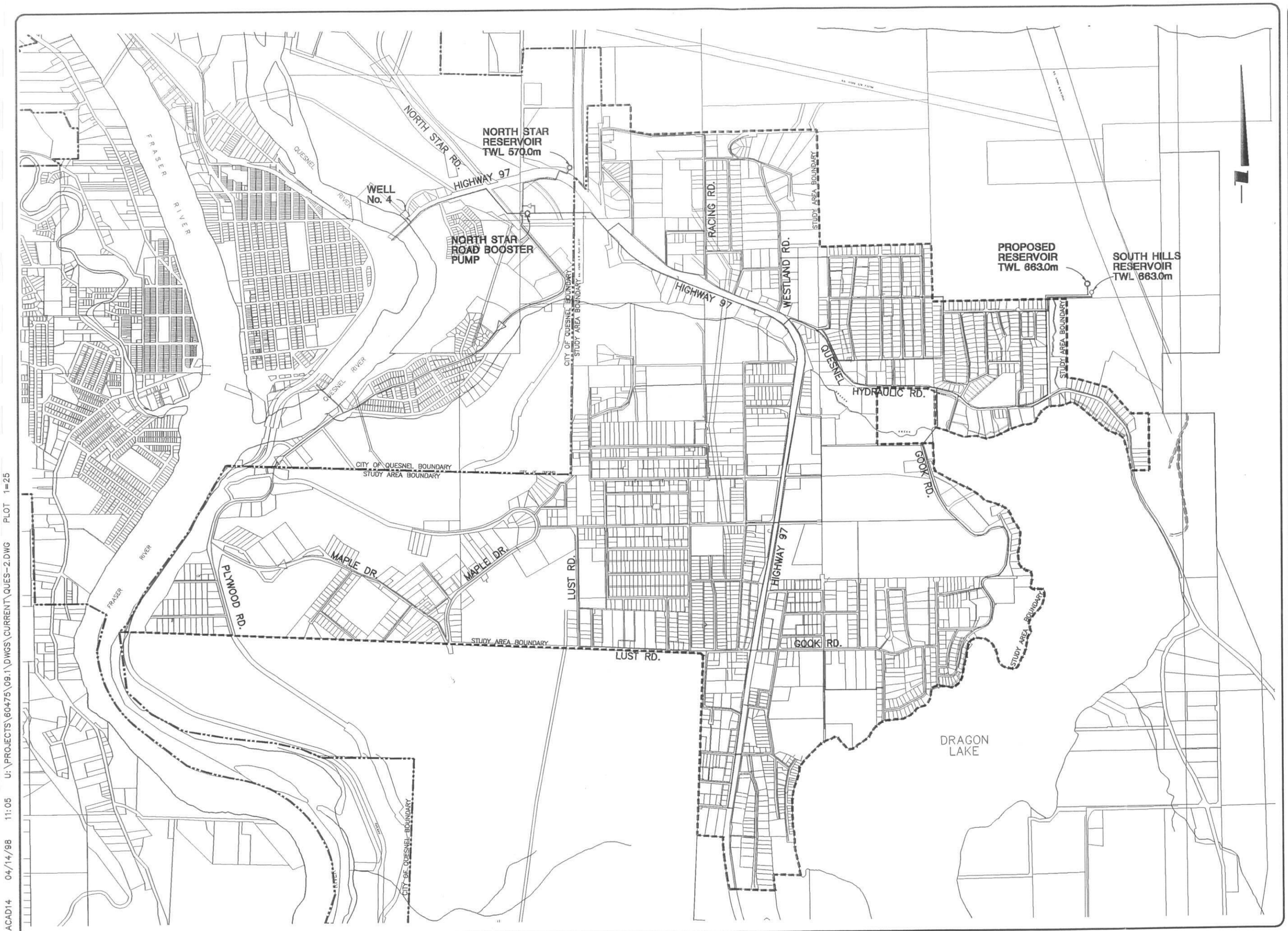
3.1 Residential

The residential zoning for the Quesnel Fringe Area includes single family dwelling units, mobile homes and multi-family dwellings. Presently there are approximately 2,000 residential units and this is expected to increase to 3,500 dwelling units by the year 2020. The residential zoning makes up most of the Red Bluff, Dragon Lake and South Hill area.

The community of South Hills has approximately 400 dwelling units developed with a maximum of 440 units expected by the year 2020. Although this area is already serviced by a private water utility it will be included in the Red Bluff, Dragon Lake, South Hill water supply system.

3.2 Commercial / Industrial

The commercial and industrial zoned area is along both sides of the Cariboo Highway. The few existing commercial and industrial areas outside of this strip will be permitted to stay with limits on redevelopment. Commercial zoning includes car sales, repair garages, mobile home sales, drive-in restaurants and the like. The industrial development permitted is only light industrial such as repair shops, building supply stores and truck sales.



CITY OF QUESNEL

CARIBOO REGIONAL DISTRICT

RED BLUFF, DRAGON LAKE, SOUTH HILLS WATER STUDY

FIGURE 6.1

DISTRIBUTION SYSTEM SCHEMATIC

SEE FIGURE 6.2 FOR PIPE SIZES

LEGEND

- CITY OF QUESNEL BOUNDARY
- RED BLUFF, DRAGON LAKE, SOUTH HILLS - WATER EXTENSION BOUNDARY
- PROPOSED PIPE 350ø OR LARGER
- PROPOSED PIPE 300ø OR SMALLER
- PROPOSED PIPE BY DEVELOPMENT
- EXISTING WATER WORKS
- PRV

SCALE 1 : 25000

DATE: APRIL, 1998
FILE No. 6047509.1

Prepared by:
URBAN SYSTEMS
consulting planners and engineers

3.3 Schools

The Fringe Area contains four schools. Lakeview Elementary servicing Dragon Lake, Red Bluff Elementary servicing Red Bluff, Dragon Lake Elementary servicing South Hills and Maple Drive Junior Secondary servicing all three. Each school is expected to increase in size to accommodate student enrollment from its neighboring population.

4. Demand and Growth Analysis

In the past 30 years the average annual growth rate has varied from 1.7% to 4.7% in the Quesnel Fringe Area. An estimate of 3% is reasonable to project future growth in the area and demand on the water system. The following table projects the anticipated population of the study area.

Year	1998	2000	2005	2010	2015	2020
Population	6,500	6,800	7,700	8,700	9,800	11,200

These populations were used to project the water demand for today and for the year 2020.

Based on an estimated maximum day demand of 1,350 litres per capita per day the following table projects the anticipated supply requirements for the study area.

Year	1998	2000	2005	2010	2015	2020
Required Supply (m^3/d)	8,775	9,180	10,395	11,745	13,230	15,120

Service to commercial and industrial land will add another 3,197 m^3/day to the projected consumption for the year 2020. For planning purposes, the total required supply capacity is calculated to be 18,317 m^3/day.

The City of Quesnel has several wells producing in the order of 4500 litres per minute (6480 m^3/d). Preliminary indications are that chances of developing wells of similar capacity along the south bank of the Quesnel River are good. Based on this possible yield, approximately 4 new wells will be required to meet the supply requirements for the study area.

The City well system presently has one well in reserve capacity. A minimum of one well should remain in reserve capacity to allow for isolated well failures.

5. Water Supply and Storage

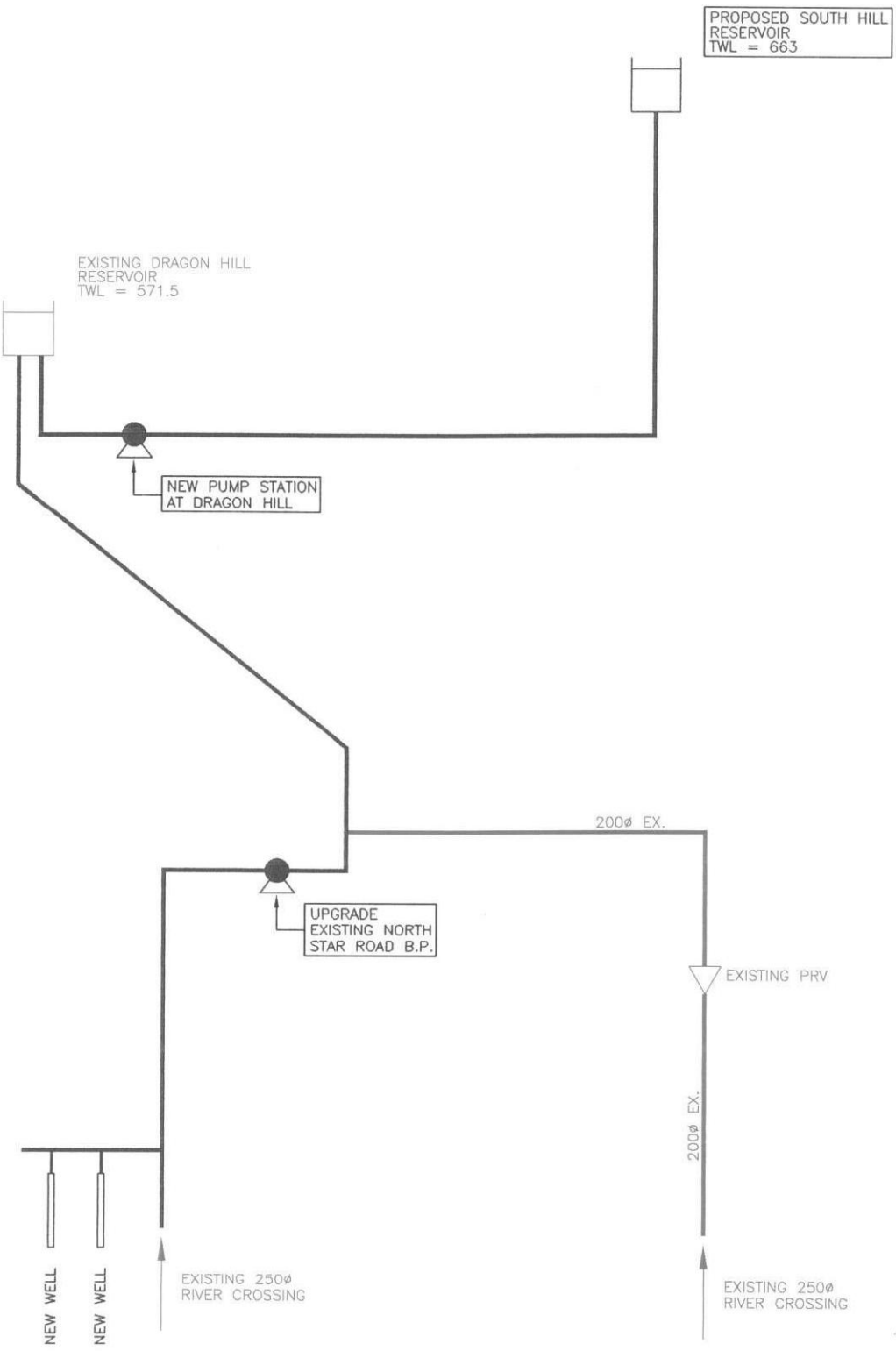
Water supply to the City of Quesnel is presently derived from Wells 5,6,7 & 8 which provide a total combined output of 21,818 cu.m./day (4.8 MIGPD). The present supply requirement is 16,818 cu.m./day (3.7 MIGPD) which represents the current maximum daily demand. Under present conditions one well remains available for backup in the event of pump failure. The City supply is therefore adequate to meet its present requirements.

With use of the standby well the capacity of the existing wells is adequate to accommodate an additional 1,250 residences but in the event of a well failure emergency measures to control water consumption will have to be implemented.

The potential to develop a new well, on the south bank of the Quesnel River, is good. The City previously had a well in this location, Well No. 4, which initially produced 4,580 cu.m./day (1.0 MIGPD). This capacity has fallen to about 1970 cu.m./day as a result of sand being drawn into the well. This well is no longer in use. The City has made preliminary inquiries into developing a new well at this location, for planning purposes we would recommend a budgetary sum of $225,000 for this purpose. As a minimum, we recommend this well be developed as part of the immediate strategy for provision of an emergency water supply to South Hills.

In looking to extend water to the present population of South Hills, Red Bluff and Dragon Lake the maximum day demand is estimated to be 8,813 cu.m/day (1.9 MIGPD). This increases to 18, 317 cu.m./day (3.9 MIGPD) for the design population of 11,200 persons. Allowing for the one well developed as part of the supply to South Hills we recommend the City plan for development of at least two more wells as part of the supply system for this study area. To allow for piping, power and well house construction we recommend a sum of $450,000 be budgeted for development of each of these wells.

Figures 5.1, 5.2 & 5.3 illustrate optional arrangements for the configuration of trunk system components to supply water to South Hills, Red Bluff and Dragon Lake. Each option takes into consideration the existing Dragon Hill Reservoir which provides balancing storage for the 571.5 m. pressure zone and emergency fire storage for South



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DATE : APRIL, 1998
Project No. 6047509.1

RED BLUFF, DRAGON LAKE, SOUTH HILLS
WATER STUDY

OPTION 1 :

TWO STAGE LIFT TO SOUTH HILL RESERVOIR

FIGURE No.
5.1

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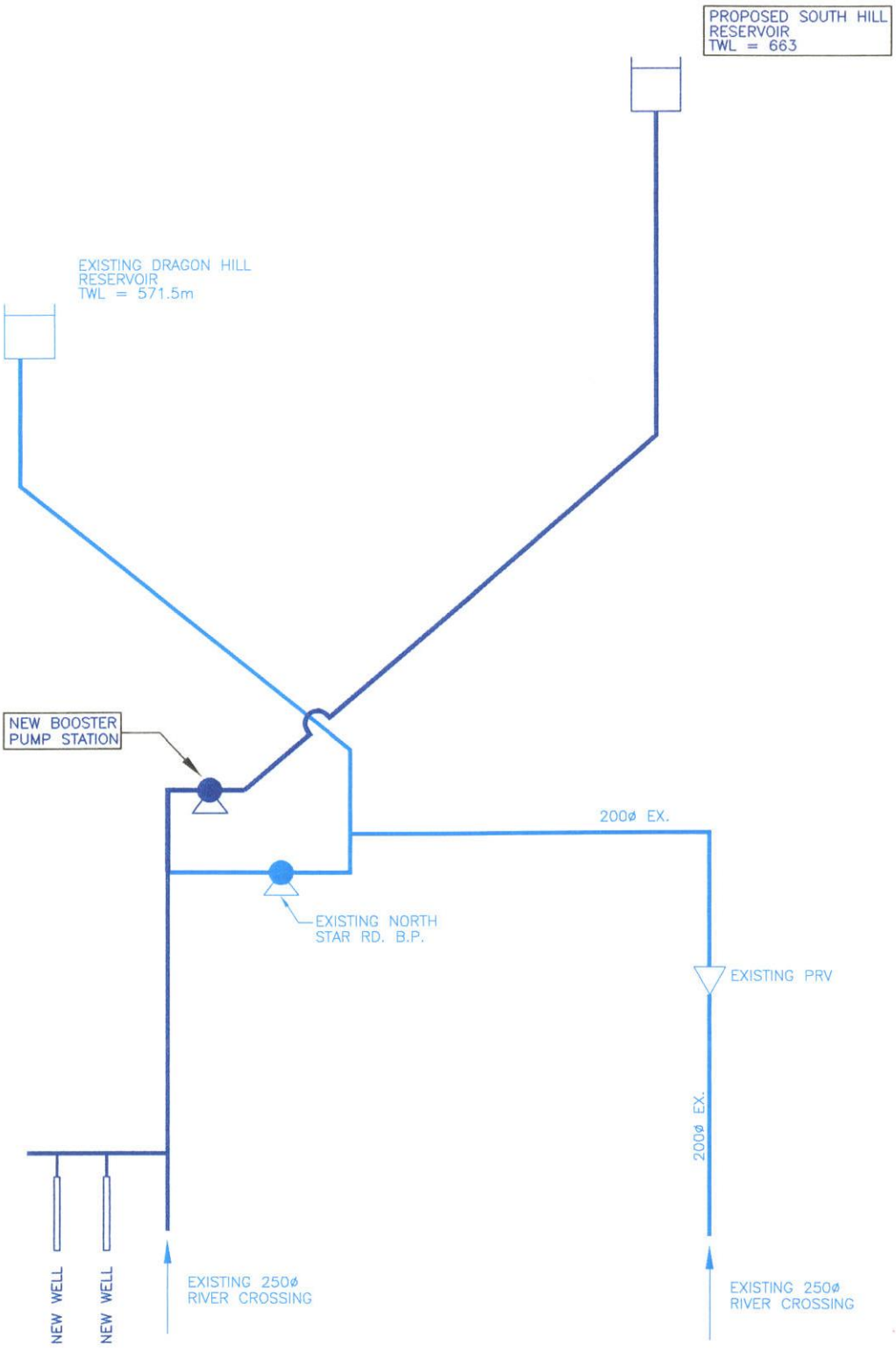

DATE : APRIL, 1998
Project No. 6047509.1

RED BLUFF, DRAGON LAKE, SOUTH HILLS
WATER STUDY

FIGURE No.
5.2

OPTION 2 :

BUILD NEW BOOSTER PUMP STATION -
LEAVE NORTH STAR BOOSTER PUMP AS-IS

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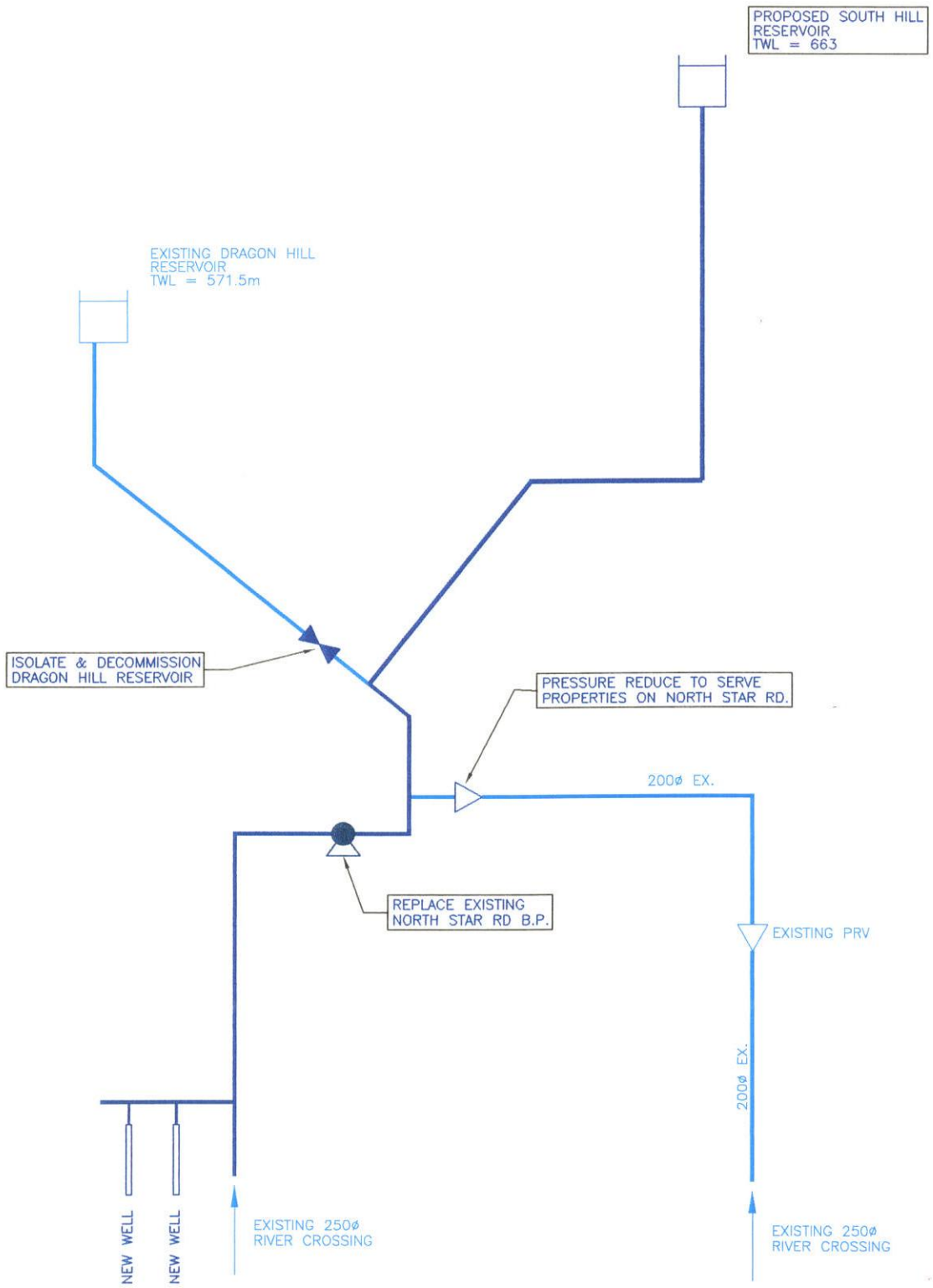

DATE : APRIL, 1998
Project No. 6047509.1

RED BLUFF, DRAGON LAKE, SOUTH HILLS
WATER STUDY

FIGURE No.
5.3

OPTION 3 :

ABANDON DRAGON HILL RESERVOIR - REPLACE NORTH STAR BOOSTER PUMP

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Quesnel. Water is pumped to the reservoir from the North Star Road Booster Pump Station. This pump station is supplied with water from the Quesnel system via a 200mm diameter pipe extending from the 250mm diameter river crossing at Highway 97. The 200 mm water main and the North Star Booster Pump Station are too small to adequately accommodate supply requirements for the study area. In all options the 200mm water main is replaced by a 400mm water main which will serve as the main conduit from the proposed wells.

Option 1 is based on pumping from the Dragon Hill reservoir up to the South Hill reservoir. This would involve the construction of a new pump station at the Dragon Hill reservoir plus a major upgrading of the North Star Booster Pump Station. As this option would be essentially equivalent to building two booster pump stations to transfer water to South Hills it would be considerably more expensive than either of the other two options. Option 1 was therefore considered uneconomic and not considered further.

Option 2 is based on leaving the North Star Booster Pump system as-is and building a new pump station directly adjacent to this site for the transfer of water to the South Hill Reservoir. The new booster pump station would be configured with space for 5 - 150 h.p. multi-stage vertical turbine pumps. Three pumps would be installed now to meet present water supply requirements and two would be installed later to meet future water supply requirements. The cost to construct the station with three pumps is estimated to be $1,500,000. The cost to install two additional pumping units is estimated to be $250,000. The cost for land acquisition to accommodate the proposed pump station is not included in the above estimate.

The Dragon Hill reservoir serves a very limited number of customers which primarily consist of ICBC, McDonald's and the Quesnel & District Recreation Centre. The city has experienced water quality problems resulting from a lack of water circulation in this reservoir. Option 3 proposes to address this problem through decommissioning the Dragon Hill Reservoir. Customers along North Star Road would receive water from the South Hill system, a pressure reducing valve would limit the maximum pressure to an acceptable level. This system is comparable in cost to Option 2 with the following differences:

- a new pump station would replace the existing pump station, a land swap could be arranged so there would be no net loss

of land;

- the cost of the PRV would add about $35,000 to the cost of the pump station;
- the City would continue to maintain and operate only one pump station; and
- there would be no requirement to continue to maintain the Dragon Hill Reservoir.

For planning purposes we recommend the City budget for Option 3, this option can be evaluated further during the implementation stage of the program.

Storage to meet future requirements for peak hour balancing and fire protection is calculated to be 6,800 cubic metres. We recommend this be constructed as a twin cell facility with one cell attributable to construction of the initial water supply and the other cell attributable to the future distribution system. The estimated cost to construct each cell is $816,000.

6. Distribution

The Red Bluff, Dragon Lake and South Hill water system will be servicing two pressure zones. The primary zone is supplied by the South Hill reservoir at an elevation of 663 m to provide water to users at elevations between 640 m and 600 m in ground elevation. This is the entire study area except the far west reach of Red Bluff where the elevations are as low as 540 meters. This west reach can be serviced by providing a pressure reducing station on Maple Drive near Fern Road. Figure 6.1 Distribution System Schematic identifies the proposed water system to service the study area.

The distribution network is supported by a twin trunk system paralleling the Cariboo Highway. A twinned system will be easier to construct and maintain as the mains cross the highway only seven times as opposed to crossing for each service connection. Primary fire protection to the commercial zones and schools are provided via these mains. Access to hydrants provides flows where required and a twinned system eliminates a need to cross the Cariboo Highway with hoses and fire staff.

Fire flow in the commercial strip and Dragon Lake residential areas is partly dependent on a secondary loop in the proposed pipe network. This loop runs on Gook Road and through the proposed development site of District Lot 6677. These mains are essential in transmitting fire flow to the area as it is at a higher elevation. Careful consideration should be given to reviewing development applications in this area to ensure the proposed looping is constructed. The Red Bluff residential area and schools receive fire flow support through the Maple Drive and Lust Road 300 mm diameter loop.

Most local mains servicing residential areas are 150 mm diameter lines except where line pressures are affected by high ground elevations such as Felspar Road. This far reach was sized as a 250 mm diameter so that the minimum fire flow and pressures can be met. All the line sizes and contours are identified on Figure 6.2 Distribution System Pipe Sizes and Layout.

Future development in the northern areas of Red Bluff will receive service off the 250 mm diameter mains on Ash Avenue, Short Road, and Cedar Avenue as they feed off the west trunk of the Cariboo

Highway.

As South Hills will be part of the fringe area water system it is recommended that they meet the same criteria as the rest of the system. To satisfy daily demands the existing system is acceptable. To satisfy fire flow demands the network requires the addition of a 250 mm diameter line as shown in Figure 6.2. This line will follow: Brears Road, Neighbour Road, Enemark Road, Britton Road and a future extension of Britton Road to Westland Road.

CITY OF QUESNEL
CARIBOO REGIONAL DISTRICT

RED BLUFF, DRAGON LAKE, SOUTH HILLS WATER STUDY

FIGURE 3.1

LAND USE AND STUDY AREA

LEGEND

- CITY OF QUESNEL BOUNDARY
- RED BLUFF, DRAGON LAKE, SOUTH HILLS - WATER EXTENSION BOUNDARY
- 1 PRIMARY SCHOOL
- 2 SECONDARY SCHOOL
- COMMERCIAL / INDUSTRIAL
- GOLF COURSE / RESIDENTIAL
- RESIDENTIAL

SCALE 1 : 25000

DATE: APRIL, 1998
Project No. 6047509.1

Prepared by:
URBAN SYSTEMS
consulting planners and engineers

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7. Costs

7.1 Supply

Major elements of the supply system consist of:

- wells constructed along the lower banks of the Quesnel River;
- storage situated in close proximity to the reservoir which presently services the South Hills area;
- a booster pump station, which replaces the present facility on North Star Road; and
- a trunk main connecting the water source, booster station and reservoir.

Costs for the trunk system are summarized below.

Table 7.1
Summary of Trunk System Costs
Stage 1 – 1998

Location			Cost			
Street Name	**From**	**To**	**Length (m)**	**Dia. (mm)**	**Cost per m**	**Total Cost**
Quesnel Hydraulic Rd. and Tachell Rd.	South Hill Reservoir	Quesnel Hydraulic/ Hwy 97	3150	750	$780	$2,457,000
Dragon Hill Rd.	Quesnel Hydraulic/ Hwy 97	Fringe Area Boundary	1350	350	$440	$594,000
Alex Fraser Park	Fringe Area Boundary	North Star Road Booster Pump Stn.	700	400	$330	$231,000
Hwy 97	North Star Road Booster Pump Stn.	Well No. 4	900	400	$30	$297,000
Valhalla Rd.	Quesnel Hydraulic Road	Richards Rd.	1350	300	$390	$526,500
Hwy 97 Crossings	2 Locations, 350 dia.	$32,000 each				$64,000
North Star Road Booster Pump Station						$1,535,000
Refurbishing of Well No. 4						$225,000
South Hill Reservoir First Cell						$816,000
One New Well						$450,000
		Subtotal				$7,195,500
		Engineering				$720,500
		Total				$7,916,000

Table 7.2
Summary of Trunk System Costs
Stage 2 – 2008

Location	Cost
Two Additional Pumps to North Star Pump Station	250,000
South Hill Reservoir – 2nd Cell	816,000
One new well	450,000
Subtotal	1,516,000
Engineering	152,000
Total	**1,688,000**

All of the above costs are inclusive of a 20 percent contingency allowance.

Unit prices for pipe are inclusive of:

- surface restoration;
- service connections;
- imported backfill;
- hydrants;
- fittings; and
- valves.

7.2 Distribution

A detailed summation of construction costs for the distribution system is provided in Appendix A.

Unit prices for pipe are inclusive of:

- 20% contingency allowance;
- surface restoration;
- service connections;
- imported backfill;
- hydrants;
- fittings; and
- valves.

The total cost of the distribution system, including an allowance for engineering, is estimated to be $24,251,000.

8. Recommendations and Conclusions

This report confirms the feasibility of extending water service from the City of Quesnel out to the area of Red Bluff, South Hills and Dragon Lake. The cost for the supply system compares favourably with the costs contained in our memorandum of September 1996. The estimated cost for the distribution system is slightly higher. In summary, the costs are estimated to be:

Supply System	
Stage 1	$7,916,000
Stage 2	$1,688,000
Distribution System	$24,251,000

Two wells should be developed as part of the initial supply system. One well is proposed to replace Well No.4 which is presently abandoned and exists on the south bank of the Quesnel River. The location of the second well should be determined from hydro-geotechnical investigations.

Stage 2 of the supply system consists of developing two additional wells and constructing the second cell of the South Hill reservoir. Timing for this work is dependent on the rate at which development proceeds within the study area as well as the extent to which service is extended to existing residences. For the purpose of this study we have assumed this work will likely be required by 2008 based on present growth estimates.

The City should look at a DCC program to recover part of the cost of the distribution system which is attributable to new development. Based on current and projected population levels approximately 42% of the cost of the distribution system will benefit new development. This allocation may change once commercial development is taken into account.

Twin parallel water mains are proposed along Highway 97. Each main will be located in the frontage road along each side of the highway. This configuration is proposed to:

- avoid future highway crossings in extending new service connections to commercial developments on the opposite side of the highway; and
- avoid the need to extend fire hoses across the highway in responding to fire alarms.

A residential / golf course development is proposed in the area of District Lot 6677. A system of looped 300 diameter water mains is proposed in this area. These water mains are an integral part of the proposed network and are required if the distribution system is to meet performance criteria for fire protection and customer service. Development plans in this area should be carefully reviewed to ensure the intent of the looped system is maintained.

The function of the Dragon Hill reservoir should be reviewed if the City extends its boundaries to encompass the study area. Preliminary indications are that the service area for this reservoir is too small to provide adequate water turnover. Freezing and water quality issues have been identified as operational problems related to low use.

The present system of water mains in South Hills are too small to adequately convey fire flows. A 250 diameter water main is proposed to correct this situation. This is shown in Figure 6.2. The cost for this main has not been included in the total cost of the distribution system. Also, fire hydrants in South Hills are suspected of not having thrust restraint in place. The cost for these retrofits will be born out of the capital reserve and maintenance funds for the water utility.

CARIBOO
REGIONAL
DISTRICT

CITY OF QUESNEL

Red Bluff / Dragon Lake / South Hills Water Supply

Appendix A

Detailed Cost Summaries

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Costs for Distribution System

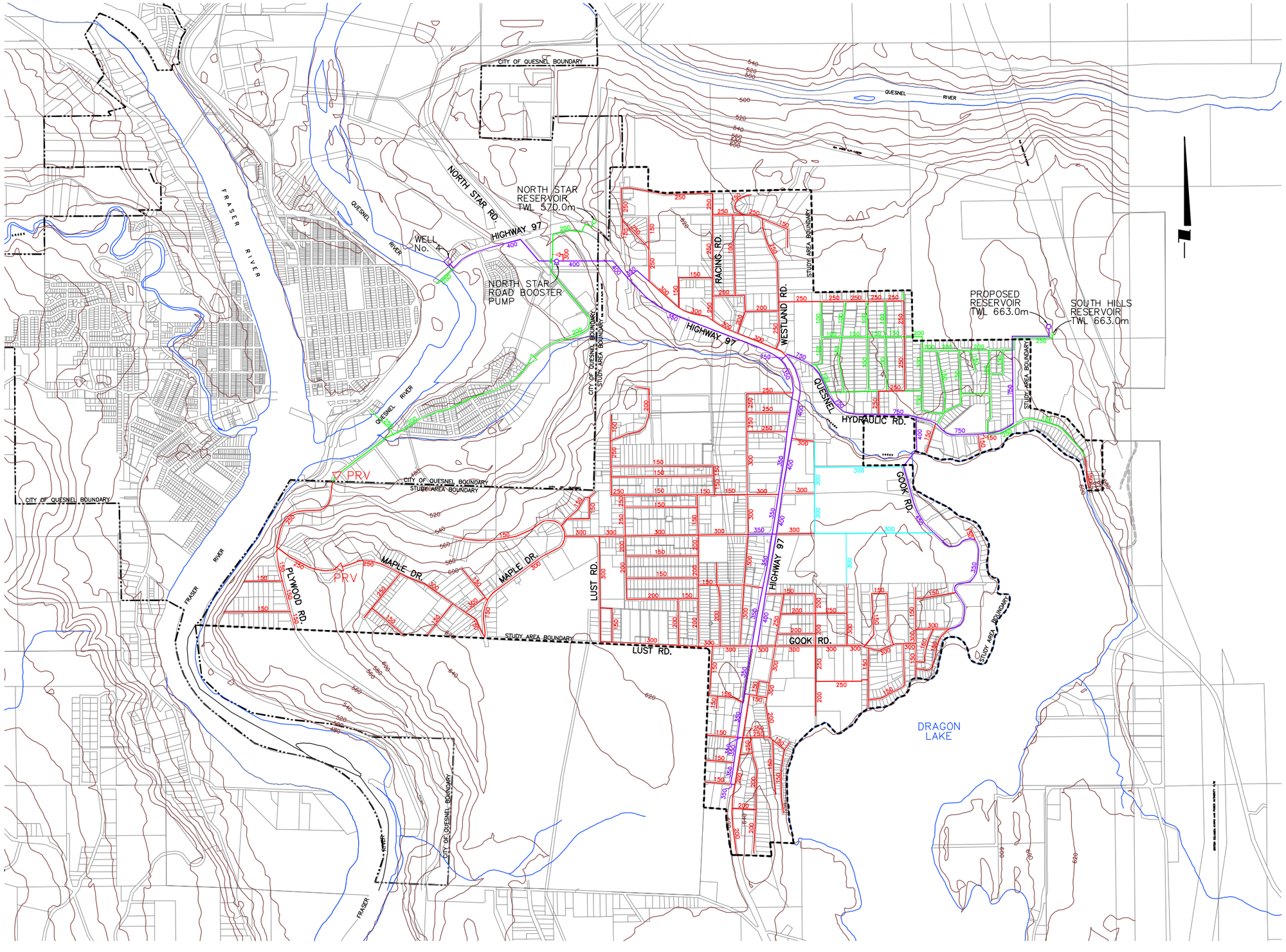
Location			Cost			
Street Name	From	To	Length (m)	Dia. (mm)	Cost per m	Total Cost
Agate Avenue	Flint Street	Crystal Street	150	150	$330	$49,500
Agate Avenue	Highway 97	Flint Street	200	250	$355	$71,000
Alder Avenue	Willow Street	North end of Road	650	200	$340	$221,000
Arbutus Road	Highway 97	Lust Road	700	150	$330	$231,000
Ash Avenue	Elm Street	Highway 97	350	250	$355	$124,250
Balsam Avenue	Elm Street	Willow Streeet	1050	150	$330	$346,500
Balsam Avenue	Highway 97	Elm Street	250	300	$390	$97,500
Basalt Road	Highway 97	Native Reserve	250	150	$330	$82,500
Bass Road	Tamarack Road	Lust Road	500	200	$340	$170,000
Beach Crescent	Gook Road	Gook Road	1000	150	$330	$330,000
Belcarra Road	Jay Road	Gook Road	350	150	$330	$115,500
Beryl Road	Gook Road	Flint Street	450	300	$390	$175,500
Birch Avenue	Willow Streeet	Fir Street	800	150	$330	$264,000
Borregard Road	Maple Drive	West end of Road	1050	150	$330	$346,500
Briar Road	Maple Drive	End of Road	300	150	$330	$99,000
Caragana Road	Plywood Road	River Bank	500	150	$330	$165,000
Cedar Avenue	Elm Street	Highway 97	300	250	$355	$106,500
Chew Road	Ferguson Street	Highway 97	150	300	$390	$58,500
Croft Road	Gook Road	Future Golf Course	500	300	$390	$195,000
Crystal Street	Agate Avenue	South End	550	150	$330	$181,500
Cypress Road	Laurel Road	Mountain Ash Road	600	150	$330	$198,000
Dennis Road	Ryan Drive	Westland Road	650	150	$330	$214,500
Dogwood Road	Laurel Road	Redwood Road	400	200	$340	$136,000
Dogwood Road	Redwood Road	Mountain Ash Road	150	150	$330	$49,500
Ellison Road	Ellison Sub. Road	End of Road	300	150	$330	$99,000
Ellison Sub. Road	Maple Drive	End of Road	350	250	$355	$124,250
Elm Street	Cedar Avenue	Ash Avenue	300	250	$355	$106,500
Elm Street	Maple Drive	Cedar Avenue	800	300	$390	$312,000
Felspar Road	Highway 97	South End	1150	250	$355	$408,250
Ferguson Street	Chew Road	Weldon Road	250	150	$330	$82,500
Fir Street	Balsam Avenue	Birch Avenue	200	150	$330	$66,000
Flint Street	Beryl Road	Agate Avenue	300	300	$390	$117,000
Flint Street	Highway 97	Beryl Road	150	250	$355	$53,250
Future Golf Course	All Future Lines		3400	300	$390	$1,326,000
Gassoff Road	Westland Road	Valhalla Road	500	200	$340	$170,000
Gook Rad	Lakeview Crescent	Highway 97	1500	300	$390	$585,000
Gook Road	Quesnel Hydraulic Road	Lakeview Crescent	1900	350	$440	$836,000
Gook Road	Quesnel Hydraulic Road	Larch Road Extension	400	400	$510	$204,000
Granite Road	Highway 97	Native Reserve	225	150	$330	$74,250
Hausman Road	Lust Road	Lust Road	500	150	$330	$165,000
Hemlock Avenue	Willow Streeet	Fir Street	800	150	$330	$264,000
Highway 97 Crossings	6 Locations, 350 to 400 dia	Approx 50m each =	400	400	$510	$204,000

Costs for Distribution System

Location			Cost			
Street Name	From	To	Length (m)	Dia. (mm)	Cost per m	Total Cost
Highway 97 East						
Frontage Road	Flint Street	Quartz Road	700	300	$390	$273,000
Highway 97 East Frontage Road	Quesnel Hydraulic Road	Gook Road	2400	400	$510	$1,224,000
Highway 97 West Frontage Road	Quesnel Hydraulic Road	Quartz Road	3100	350	$440	$1,364,000
Jay Road	North of Belcarra Road	Gook Road	350	150	$330	$115,500
Kube Street	Balsam Avenue	Poplar Avenue	100	150	$330	$33,000
Kube Street	Poplar Avenue	Maple Drive	200	150	$330	$66,000
Lakeview Crescent	Gook Road	Gook Road	750	150	$330	$247,500
Lakeview Drive	Lakeview Crescent	Gook Road	300	150	$330	$99,000
Larch Road	Highway 97	East end of Road	300	300	$390	$117,000
Laurel Road	Maple Drive	Dogwood Road	500	200	$340	$170,000
Lombardie Road	Laurel Road	Mountain Ash Road	600	150	$330	$198,000
Lust Road	Highway 97	Maple Heights Road	100	350	$440	$44,000
Lust Road	Maple Heights Road	Maple Drive	1800	300	$390	$702,000
Maple Drive	Ellison Sub. Road	Plywood Road	1000	250	$355	$355,000
Maple Drive	Elm Street	Ellison Sub. Road	3100	300	$390	$1,209,000
Maple Drive	Highway 97	Elm Street	150	350	$440	$66,000
Maple Heights Road	Maple Drive	Lust Road	900	300	$390	$351,000
Marble Street	Agate Avenue	South End	450	150	$330	$148,500
May Road	Racing Road	Valhalla Road	500	150	$330	$165,000
Mica Street	Arbutus Road	South End	100	150	$330	$33,000
Mountain Ash Road	Maple Drive	Lust Road	900	200	$340	$306,000
Oak Avenue	Maple Drive	End of Road	300	150	$330	$99,000
Oval Road	Westland Road	Boundary of Fringe Area	400	150	$330	$132,000
Palm Road	Ellison Sub. Road	End of Road	100	150	$330	$33,000
Pine Drive	Pine Road	Borregard Road	350	150	$330	$115,500
Pine Road	Pine Drive	Borregard Road	300	150	$330	$99,000
Plywood Road	Maple Drive	Native Reserve	650	150	$330	$214,500
Plywood Road	Maple Drive	North to City Boundary	900	250	$355	$319,500
Poplar Avenue	Spruce Street	Kube Street	600	150	$330	$198,000
Quartz Road	Highway 97	Native Reserve	200	150	$330	$66,000
Quesnel Hydraulic Road	Lois Lane Road	East Boundary of Fringe Area	250	150	$330	$82,500
Quesnel Hydraulic Road	Redwing Road	Redden Road	400	250	$355	$142,000
Racing Road	Valhalla Road	Westholm Road	1050	250	$355	$372,750
Red Bluff Road	Maple Drive	End of Road	300	150	$330	$99,000
Redden Road	Quesnel Hydraulic Road	Dragon Lake	150	150	$330	$49,500
Redwing Road	Quesnel Hydraulic Road	Dragon Lake	250	150	$330	$82,500
Redwood Road	Dogwood Road	Lust Road	350	200	$340	$119,000

Costs for Distribution System

Location			Cost			
Street Name	**From**	**To**	**Length (m)**	**Dia. (mm)**	**Cost per m**	**Total Cost**
Richards Road	Valhalla Road	South end of Road	150	150	$330	$49,500
Richards Road	Westholhm Road	Valhalla Road	300	250	$355	$106,500
Rose Road	Maple Drive	End of Road	100	150	$330	$33,000
Ryan Drive	Gassoff Road	Racing Road	350	200	$340	$119,000
Sam Toy Avenue	Ferguson Street	Gook Road	425	250	$355	$150,875
Saskatoon Road	Maple Drive	End of Road	300	150	$330	$99,000
Short Road	Elm Street	Highway 97	325	250	$355	$115,375
Sing Street	Sam Toy Avenue	Weldon Road	250	200	$340	$85,000
Sing Street	Weldon Road	Croft Road	250	250	$355	$88,750
Spruce Ridge	Gook Road	Gook Road	1000	150	$330	$330,000
Spruce Street	Balsam Avenue	Poplar Avenue	100	250	$355	$35,500
Spruce Street	Poplar Avenue	Maple Drive	200	250	$355	$71,000
Tamarack Road	Highway 97	Maple Heights Road	150	300	$390	$58,500
Tamarack Road	Maple Heights Road	Mountain Ash Road	350	150	$330	$115,500
Veneer Road	Plywood Road	River Bank	300	150	$330	$99,000
Wee Road	Gook Road	North end of Road	100	150	$330	$33,000
Weldon Road	Gook Road	Golf Course	500	200	$340	$170,000
Weldon Road	Gook Road	South	1000	250	$355	$355,000
Westholm Road	Racing Road	Richard Road	700	250	$355	$248,500
Westland Close	Westland Road	End	250	150	$330	$82,500
Westland Road	Quesnel Hydraulic Road	Racing Road	1500	250	$355	$532,500
Willow Street	Balsam Avenue	Hemlock Avenue	150	250	$355	$53,250
Willow Street	Hemlock Avenue	Alder Avenue	500	250	$355	$177,500
Wong Street	Sam Toy Avenue	Weldon Road	300	200	$340	$102,000
		Subtotal				**$22,046,250**
		Engineering				**$2,205,000**
		Total				**$24,251,250**



CITY OF QUESNEL

CARIBOO REGIONAL DISTRICT

RED BLUFF, DRAGON LAKE, SOUTH HILLS WATER STUDY

FIGURE 6.2
DISTRIBUTION SYSTEM PIPE SIZES AND LAYOUT

LEGEND

- CITY OF QUESNEL BOUNDARY
- RED BLUFF, DRAGON LAKE, SOUTH HILLS - WATER EXTENSION BOUNDARY
- PROPOSED PIPE 350ø OR LARGER
- PROPOSED PIPE 300ø OR SMALLER
- PROPOSED PIPE BY DEVELOPMENT
- EXISTING WATER WORKS

SCALE 1 : 15,000

DATE: APRIL, 1998
FILE No. 6047509.1

Prepared by:
URBAN SYSTEMS
consulting planners and engineers

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CITY OF

QUESNEL

2 & 3 MILE FLAT SEWER STUDY

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August 2000
File: 7119023.1

CITY OF QUESNEL

2 & 3 Mile Flat Sewer Study

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DRAWINGS

1. INTRODUCTION

1.1 Background

The City of Quesnel, on March 22, 2000, authorized Urban Systems Ltd. to review the Two and Three Mile Flat Sewer Study prepared by Stanley Associates Engineering Ltd. in December of 1993. The objective of the review was to generate realistic and up to date cost estimates in preparation for the anticipated announcement of a Provincial/Federal Infrastructure Cost Sharing Program.

The existing Quesnel Sanitary Sewage Collection System extends as far north as Gordon Avenue and flows southward to the High Lift Station near the confluence of the Quesnel and Fraser Rivers.

The Two and Three Mile Flat areas lie immediately to the north of Gordon Avenue and extend northward 2.5 km to the south boundary of the Quesnel Airport. Sewage disposal in the study area is presently accomplished utilizing septic tanks and disposal fields.

1.2 Study Objectives

The main objectives of this study update were as follows:

i) Prepare a plan of the study area with topographic mapping at a 1:2000 scale.

ii) Prepare profiles along all proposed sewer main alignments.

iii) Prepare preliminary sewer main designs on all profiles to more accurately determine quantities and depth ranges of sewer mains.

iv) Prepare meaningful cost estimates based on our preliminary design to reflect anticipated costs for construction in the year 2000.

2. STUDY CRITERIA

2.1 General

This section will define the criteria used to identify the anticipated flows from the Two and Three Mile Flat areas once the existing subdivisions are fully developed and the flows expected to be generated from new subdivisions within the study area. For economy reasons, this study update has relied on the numbers used in the 1993 study with respect to areas of future development. The topographic mapping previously prepared by Delta Aerial Surveys Ltd. was utilized to prepare profiles of the proposed sewer main alignments.

The mapping consisted of 12 topographic drawings and these were overlain onto a composite drawing of the area provided by the Ministry of Transportation and Highways. An additional subdivision plan of the Campbell Crescent area was obtained from the Prince George Land Registry to complete the lot layout of the study area.

It is understood the area is serviced with water by the City of Quesnel and with natural gas by BC Gas Utility Ltd. but the precise alignments of the sanitary sewer in the study area was not addressed at this juncture and will be addressed during the final design stage.

2.2 Design Flows

The estimated flows for sanitary sewage in the study area as used in the 1993 study were used in our current study update. Generally these were flows of 980 m^3 per day from the existing development in the study area and an allowance of 1150 m^3/day for new development areas and 240 m^3 per day for expansion of existing developments within the proposed service area. A peaking factor of 2.0 was used to determine maximum flows throughout the study area.

3. EXISTING SYSTEM

3.1 Existing Collection System

Sewers in the area known as North Quesnel (the area bounded by the Quesnel and Fraser Rivers) extend as far north as Gordon Avenue. The sewage flows from North Quesnel southward to the High Lift Station located near the confluence of the Quesnel and Fraser Rivers. The north/south collection mains for the most part are located in lanes and generally consist of 150, 200 and 250 mm Ø asbestos cement piping. A study completed in December, 1994 by Stanley Associates Engineering Ltd. identifies that some portions of the existing collector are currently overtaxed and no portions of the collector main are capable of handling the ultimate flows expected from the study area.

If the sewage flow from the Two and Three Mile Flat area were to be collected at the High Lift Station it would require a total upgrade of one of the existing collection mains (located in narrow lanes) or a new dedicated main located in one of the existing streets which pass through the business district.

4. PRELIMINARY DESIGN – TWO AND THREE MILE FLAT AREA

4.1 General

The preliminary design was based on profiles generated from topographic mapping of the Two and Three Mile Flat areas produced by Delta Aerial Surveys Ltd. and purchased from Delta by Urban Systems Ltd.

Two alternatives for the Two and Three Mile Flat trunk main previously identified in the 1993 Stanley Associates study were not thoroughly investigated due to the difficulties in constructability, their route traverses an identified slide area of some concern. The only route studied for the trunk main was the combination gravity main/force main on River Park Road tying in to the existing forcemain from the High Lift Station to the Cariboo Pulp and Paper Company treatment plant.

4.2 Two Mile Flat Area

This area includes all properties within the City limits adjacent to Highway 97 between the River Park Road/Highway 97 intersection and Hilltop Road, including roads intersecting Highway 97.

The properties at the corner of Sutherland and Highway 97, presently occupied by Quesnel Plumbing and Heating and Supersave Gas, are proposed to be serviced by a gravity main from River Park Road up Hazel Road and crossing under the BC Railway. The costs of servicing these two properties ($113,000) plus E & C have been included in this report. Alternatively, the option of extending the existing 150 Ø sewer north of Gordon Road exists which would realize a cost reduction in the amount of ± $70,000. The existing line north of Gordon Road is a 150 Ø line and the extension would exceed the MOE guidelines for the length of 150 Ø line permitted, however, as only 2 connections would be added, we believe it is worthwhile pursuing approval in light of the $70,000 cost reduction.

The gravity main runs north from Spears Road within the Highway 97 right-of-way to Brownmiller Road, along Rome Avenue and Brownmiller Road to Highway 97 then north on Highway 97 to north of Hilltop Road. Laterals off the Highway 97/Brownmiller Road main service Spears Road, Lear Road, Commons Road, Pinecrest Road, Keis Avenue and Hilltop Drive.

Main sizes vary from 200 mm Ø to 300 mm Ø with minimum grades of 0.4% for 200 mm Ø and 0.3% for 300 mm Ø. Services generally have been sized at 100 mm Ø with some allowances for 150 mm Ø services. Manhole spacings have been set at a maximum of 150 metres. The maximum depth of mains is in the order of 5.5 metres which should not present any great difficulties.

We have assumed that all crossings of Highway 97 will require horizontal drilling so as not to disturb the existing road surface or traffic flow while all other road crossings have been assumed to be undertaken by the "open cut" method.

Similarly, we have assumed crossings of the BC Rail mainline will be accomplished by horizontal drilling and crossings of BC Rail spur lines and sidings will be accomplished by the "open cut" method.

A gravity sewer is required along McLeod R to permit gravity connections from Lots 3 & 4, Plan 5980. Lot 1, Plan 17145 (Tolko Lumber) is too low for a gravity connection and will have to pump into this sewer.

The head office for West Fraser Forest products is located at the southern extremity of Brownmiller Road. The building is located adjacent to a cul-de-sac which provides vehicle access to both the building and the BC Hydro storage yard. Both properties require a service.

The West Fraser building is built into an embankment with the lower portion well below the cul-de-sac. A gravity connection is only possible from the back otherwise it will have to pump up to the cul-de-sac.

Extending the sewer straight across to Highway 97 is not an option at this location. It must cross several rail tracks as well as a propane storage and fuel yard. Many tanks and associated underground piping lie directly in the path of the sewer. The only options are either pumping up to the Brownmiller Road crossing or across to River Park Road.

Pumping to River Park Road is preferred if a right-of-way can be secured across the property behind West Fraser. This would allow West Fraser to connect by gravity to the sewer system. The pump station and controls will need to be sited above the 200 year flood elevation as the property may be subject to flooding.

The alternative is to stay within the established rights-of-way, locate a pump station at the intersection of the cul-de-sac and Brownmiller Road, and pump back up to the Brownmiller Road crossing. West Fraser will likely have to pump up to the sewer with this option. As this involves the construction of an additional pump station and a longer force main we have rejected this option.

4.3 Three Mile Flat Area

This area services all properties on Highway 97 from Hilltop Road to 600 metres north of Quesnel Hixon Road, 1150 metres on Quesnel Hixon Road from Highway 97 westward, Campbell Crescent and Carradice Road.

The mains in this area are all 200 mm Ø and are all predesigned to be at a minimum grade of 0.4% for approximately 700 metres on Quesnel Hixon Road approaching Highway 97 and on Highway 97 south from Quesnel Hixon Road. Depths will be in the 6.5 – 7.5 metre depth range. While this will present some construction difficulties, it will still prove cost effective compared to shallower main depths in combination with a lift station and force main.

Manhole spacing has been maximized at 150 m and service connections have been sized at 100 mm Ø with an allowance for some 150 mm Ø services. The crossing of Highway 97 has been assumed to be by horizontal drilling and all other road crossings have been assumed to be performed by the "open cut" method.

4.4 Walkem Street North

The area proposed to be serviced lies between Spears Road to the north, Highway 97 to the east, Gordon Road to the south and the Fraser River to the west. The area is small and will require easements through private property. The area is identified by D.J. McDougall in his report "Landslides in Tertiary Deposits" as being in a slide prone area. The disposal fields from septic tanks have been identified as a possible factor to the slide movement in the area.

We have identified a system of septic tanks, holding tanks complete with pumps and a low pressure main discharging into an existing manhole on Walkem at Gordon Avenue. It is conceivable the existing septic tanks will be adequate for the proposed system and only the installation of holding tanks with pumps and the low pressure forcemain will be required.

A significant portion of the area is landscaped and developed and detailed survey data will be required to determine the preferable route. The location for the forcemain shown on Drawing A-1-C01 is conceptual only. Provision has been made in the cost estimates for the reduction of odors at the discharge manhole on Walkem Avenue. With only 9 connections, the existing gravity system south of Gordon Avenue is considered adequate for the relatively minor increase in expected flow.

4.5 Connection to City Sewage System

The only option originally proposed in the Stanley Associates 1993 study that has been cost updated in this review is the River Park Road option connecting directly to the existing City of Quesnel forcemain.

We have dismissed costing out the other 2 options, most notably the installation of a new main down Front Street or the River Front walkway for the following reasons:

- Both routes traverse the slide area identified by D.J. McDougall;
- Both routes would cause great inconvenience to the local citizens and would inevitably be open to much criticism;
- Front Street is the only north south route through Quesnel and would present tremendous construction difficulties and inefficiencies;
- In all probability, the mains along the walkway route would be in the ground water table a significant portion of the year leading to the potential of increased infiltration.

The River Park Road route would see the trunk main leave the Highway 97 corridor approximately 200 metres north of the Highway 97/River Park Road intersection, travel under the BC Rail mainline and enter River Park Road about 125 metres east of Highway 97. The trunk main would head in an easterly direction on River Park Road until the main would be in the 4.5 to 5.0 meter depth range. At that point, a lift station would be located and the sewage would be pumped by forcemain along River Park Road to connect to the existing forcemain near the BC Rail Quesnel River Bridge.

No allowance has been made to service the properties along River Park Road since it is outside the City of Quesnel boundaries. However, servicing of these properties, if desired, could be accomplished at a lower cost per connection than the existing proposed service area of Two and Three Mile flats.

5. COST ESTIMATES

5.1 Derivation of Estimate

The enclosed cost estimates are based on recent projects carried out in the Interior of British Columbia including the 1999 construction of the South Quesnel Water System. Construction costs from other areas used as a reference have been adjusted to reflect the probable costs to be expected in the Quesnel area. All costs are based on 2000 dollars reflecting the anticipated cost if construction were to occur in 2000. Allowance has been made to accommodate the large price increase in PVC pipe that has occurred since 1999.

No allowance has been made for the acquisition of property or easements.

5.2 Three Mile Flat Area

A.	Sanitary Mains - 200 Ø				
	i)	0 - 2.5 m depth	910 m @ $90	$	81,900
	ii)	2.5 - 3.5 m depth	1055 m @ $105	$	110,775
	iii)	3.5 - 4.5 m depth	205 m @ $125	$	25,625
	iv)	4.5 - 5.5 m depth	70 m @ $180	$	12,600
	v)	5.5 - 6.5 m depth	65 m @ $240	$	15,600
	vi)	6.5 - 7.5 m depth	750 m @ $295	$	221,250
B.	Services				
	i)	100 Ø	68 @ $1,000	$	68,000
C.	Horizontal Drilling				
	i)	400 mm Ø	35 m @ $1,500	$	52,500
D.	Manholes				
	i)	Bases, Frames, Covers	26 @ $1,400	$	36,400
	ii)	1050 Ø Barrels	100 vm @ $375	$	37,500

E.	Restoration			
	i)	Asphalt Surface	1500 m² @ $27	$ 40,500
	ii)	Gravel Surface	4000 m² @ $12	$ 48,000
	iii)	Other	18000 m² @ $3	$ 54,000
Sub-Total				**$ 804,650**
Contingency & Engineering (30%)				$ 241,350
TOTAL				**$ 1,046,000**

5.3 Two Mile Flat Area

A.	Sanitary Mains - 300 Ø			
	i)	0 - 2.5 m depth	30 m @ $115	$ 3,450
	ii)	2.5 - 3.5 m depth	220 m @ $130	$ 110,775
	iii)	3.5 - 4.5 m depth	770 m @ $150	$ 115,500
	iv)	4.5 - 5.5 m depth	120 m @ $205	$ 24,600
B.	Sanitary Mains - 200 Ø			
	i)	0 - 2.5 m depth	450 m @ $90	$ 40,500
	ii)	2.5 - 3.5 m depth	3515 m @ $105	$ 369,075
	iii)	3.5 - 4.5 m depth	825 m @ $125	$ 103,125
	iv)	4.5 - 5.5 m depth	80 m @ $180	$ 14,400
C.	Services			
	i)	100 Ø	75 @ $1,000	$ 75,000
	ii)	150 Ø	7 @ $1,100	$ 6,600
D.	Horizontal Drilling			
	i)	400 mm Ø	280 m @ $1,500	$ 420,000
E.	Manholes			
	i)	Bases, Frames, Covers	52 @ $1,400	$ 72,800
	ii)	1050 Ø Barrels	160 vm @ $375	$ 60,000

F.	Restoration			
	i)	Asphalt Surface	17500 m² @ $27	$ 472,500
	ii)	Gravel Surface	5300 m² @ $12	$ 63,600
	iii)	Other	11500 m² @ $3	$ 34,500
G.	Lift Station			$ 60,000
Sub-Total				**$ 2,046,425**
Contingency & Engineering (30%)				$ 613,575
TOTAL				**$ 2,660,000**

5.4 Walkem Street North

A.	Pressure Main	400 m @ $75	$ 30,000
B.	Septic Tanks & Pump Chambers	9 each @ $5,000	$ 45,000
C.	Odour Removal @ Walkem	Allowance	$ 4,000
D.	Restoration		
	i) Asphalt Surface	500 m² @ $27	$ 13,500
	ii) Landscaped	800 m² @ $7	$ 5,600
	iii) Other	1200 m² @ $3	$ 3,600
Sub-Total			**$ 101,700**
Contingency & Engineering (30%)			$ 30,300
TOTAL			**$ 132,000**

5.5 Connection to Quesnel Sewer System

A.	Forcemain	1100 m @ $110	$ 121,000
B.	Connection to Existing Force Main	1 @ $10,000	$ 10,000
C.	Horizontal Drilling	70 m @ $1,500	$ 105,000

D.	Restoration			
	i)	Asphalt	1500 m² @ $27	$ 40,500
	ii)	Gravel	500 m² @ $12	$ 6,000
	iii)	Other	3000 m² @ $3	$ 9,000
E.	Lift Station (Basic Package)			$ 240,000
Sub-Total				**$ 531,500**
Contingency & Engineering (30%)				$ 159,500
TOTAL				**$ 691,000**

Note:

i) To include small building to house electronics, controls, etc., an additional allowance of $60,000 (including 30% contingency) would be required.

ii) To provide standby power an additional allowance of $105,000 for controls, generator and expanded building would be required.

5.6 Summary of Costs

A.	Three Mile Flat Area	$ 1,046,000
B.	Two Mile Flat Area	$ 2,660,000
C.	Walkem Street North	$ 132,000
D.	Connection to Quesnel System	$ 691,000
TOTAL COST		**$ 4,529,000**

6. SUMMARY

6.1 Summary

The existing gravity sewer system in the North Quesnel area is totally inadequate to accommodate the expected sewage flows from the Two and Three Mile Flat areas.

Due to several compelling reasons, previous alternate routes along Front Street or the River Walkway have been eliminated and the proposed route to connect the study area to the City system is along River Park Road to the existing City forcemain.

The total estimated cost to service the Two and Three Mile Flat areas is in the order of $4,529,000 including only a basic Lift Station on River Park Road or $4,694,000 including a lift station with allowances for a control building and standby power.

Discussions with MoTH indicate they are planning a major reconstruction of Highway 97 through the Two and Three Mile Flat areas in the Year 2001. Significant cost savings could be realized if the sewer system installation along Highway 97 could be accomplished prior to the reconstruction of Highway 97 in the affected area.

CITY of QUESNEL

SOUTH HILLS
SEWER EXTENSION

FEASIBILITY STUDY

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December 2001

CITY of QUESNEL

SOUTH HILLS SEWER EXTENSION

FEASIBILITY STUDY

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APPENDICES

CITY of QUESNEL

SOUTH HILLS SEWER EXTENSION

FEASIBILITY STUDY

EXECUTIVE SUMMARY

This report analyses two basic options for extending the sewage collection system to the South Hills area.

The study area consists of 108 existing lots ranging in size from 0.2 to 2.2 hectares, with 77 lots presently occupied. Five options have been considered in this report, as follows:

- Options 1 and 2 employ residential pumped systems (STEP, Grinder and Solids-Handling) and a low pressure collection system;
- Options 3 and 4 involve the use of gravity collection systems, with a few pumped services where gravity service is not possible; and
- Option 5 is a combination of the gravity and the low-pressure collection systems to minimize the length of deep gravity mains.

The various servicing options are divided into sub-areas. This division accounts for the possibility that residents in some sub-areas may elect to delay or opt out of connecting to the municipal sewer system if they are not experiencing problems with their septic systems. It also identifies that phasing of construction could follow by sub-area or by a combination of sub-areas.

A gravity system is the preferred option over the long term, from an operation and maintenance perspective. There are fewer problems for both residents and City maintenance staff with a gravity system, than compared to a low-pressure collection system. The preferred gravity system would utilise road rights-of-way where possible (Option 4) to minimise impacts on private property.

There are known health problems that are attributed to failing septic systems in the study area. The elimination of public health risks is a priority issue for the province and is eligible for funding through the Local Government Infrastructure Grant. The City should investigate this opportunity, as funding of 25% and perhaps up to 50% of the capital cost may be possible.

The cost per lot for the two gravity systems with Provincial funding ranges from $9,000 to $12,400. The cost per lot for the two gravity systems without Provincial funding ranges from $15,500 to $15,600. Appendix E provides a breakdown of the costs based on these levels of funding.

The study area will require a detailed topographic survey during preliminary design to ascertain where gravity service can be provided.

1.0 INTRODUCTION

1.1 Background

The City of Quesnel extended the municipal boundary in 1999 to include the South Quesnel area. Prior to 1999, the South Hills area was under the jurisdiction of the Cariboo Regional District. In 1984, the Cariboo Regional District completed the construction of the Red Bluff sanitary sewer system and as such, a portion of the South Hills area has been provided with sanitary sewer service. The remaining residents use septic tank and drain field systems to dispose of wastewater.

In 1992, the residents of a portion of the South Hills area that are not provided with sanitary sewer service petitioned the Cariboo Regional District to extend the collection system to service their homes. That portion comprised 40 lots bounded by Racing Road on the west, Dennis Road on the east, Ryan Road on the south and Westland Road on the north. Of the 40 lots, 23 were developed and 17 were vacant.

The residents were experiencing problems with their septic systems failing, specifically: overflow; surcharging; back-flow into homes; and infiltration into the septic tanks. Problems were repeatedly communicated to the Public Health Officer, as outlined in the letter included in Appendix A. In 1993, the Cariboo Regional District commissioned L & M Engineering Ltd. to study the feasibility of providing sanitary sewer service to this area. The study was completed in January 1993 and an update was provided September 1994 to include evaluations of small-diameter pressure system options.

The findings of that study were presented to the residents. A public vote was held to regarding the construction of the new collection system but the resolution was defeated by a very slim margin.

With the expansion of the City boundary in 1999, the City of Quesnel is now re-exploring the possibility of providing sanitary sewer service to the area at the request of the local residents. The City has adopted the position that conducting a review of extending the municipal sanitary sewer system should consider the entire area that could ultimately be serviced. Therefore, the extent of the study area has been expanded from the limits of the original feasibility study to include the properties surrounding the original 40 lots. The extent of the study area for this report is shown in Figure 1.1.

1.2 Study Area Characteristics

All of the land in the study area is zoned single and two-family residential, R-1 and R-4 respectively. The study area consists of 108 lots ranging in size from 0.2 to 2.3 hectares. 77 lots are presently occupied and 31 lots are vacant.

Most of the larger lots, occupied or not, are heavily treed with thick underbrush. The smaller lots tend to be heavily treed between and behind the houses. The terrain is undulating, with the slopes in the northerly and easterly sections being quite steep, while the southern section slopes gently to the south.

Potable water and fire protection is supplied by a local community system. Drainage is via open ditches to local watercourses and/or low areas. As previously indicated sanitary sewage is disposed of by individual septic systems.

1.3 Study Objective

The purpose of this study is to examine the feasibility of providing sanitary sewer service to the residents of the study area. Plausible servicing alternatives are described and specific servicing concepts are illustrated.

Cost estimates have been prepared that include capital costs, operation and maintenance costs, legal survey costs and engineering. The issues related to each servicing option are outlined and costs per lot are identified.

The assessment of plausible sewer collection options and the related economic analysis provide a basis for recommending a viable option for servicing the residents of the study area.

2.0 REVIEW OF COLLECTION SYSTEM ALTERNATIVES

The selection of the optimal collection system must consider the unique characteristics of the service area. Topography, land use and density as well as the responsibility of private and municipal stakeholders must be considered. Two potential options for the collection of sewage have been identified for the service area.

2.1 Low Pressure Pumped System

There are two general classifications for low pressure pump systems; Septic Tank Effluent Pumping (STEP) Systems and Residential Pump Station Systems (either solids-handling pumps or grinder pumps).

Septic Tank Effluent Pumping (STEP) System

In this option, sewage from the house flows by gravity into the existing (or new) septic tank. A low pressure pump is installed in, or downstream of, the septic tank and the effluent is pumped into a small diameter force main. The elimination of large solids in the effluent eliminates the need for a pump with solids handling capability and minimizes the opportunity for the clogging of the pump.

STEP systems convey the liquid portion of wastewater off-site. On-site disposal issues still arise, as the septic tank must continue to be pumped out at regular intervals. It is anticipated that the septic tanks should be pumped out at 3 year intervals. The property owner must maintain access to the septic tank such that it can be pumped out.

It is anticipated that the pumps will need replacement every 9-10 years. However, this is highly variable and is dependant on the quality of pumping equipment employed and the operating conditions. The pumps and control panels will also require yearly maintenance.

Residential Pump Station System

A below-grade pump station is installed into which the sewage is directed from the house by gravity. The pump then directs the flow to the force main. Within this classification, there are two general designs: solids-handling pump systems and grinder pump systems. The major difference is the method in which each pump handles the solids. The solids-handling pump is capable of passing the solid waste into the system (pumps range from 25 mm to 50 mm solids passing capability), compared to the ability of the grinder pump to macerate the sewage as it is pumped into the system.

If a septic tank pre-exists the upgrade, it is de-commissioned by cleaning out the tank and backfilling with granular material or pumping out the sewage and removing the tank.

A distinct advantage of the low pressure systems is that topography does not have a significant impact on the alignment or depth of the main. In areas where a deep gravity main would otherwise be required, a low pressure system pipe is installed at

the allotted depth. The minimum depth for force mains in Quesnel is 2.2 m. It should be noted that air release valves would be required at the high points in the pressure mains. These should consist of automatic sewage air release valves.

The operation of a low pressure collection system does have some disadvantages. Odour problems can occur in the first few manholes downstream from the manhole where the pressure system outlets. This can have an impact on residents in the downstream area. The possibility of such an occurrence is increased in cases where the low pressure system does not discharge into an existing raw sewage stream as there will be no dilution of the septage. The hydrogen sulphide gas that is released from the turbulent discharge of the pressure system can also corrode the concrete in the manholes. To reduce these problems, practices such as positioning the outlet of the pressure system within the length of the gravity main can be employed.

There are also issues for the owners of the private pumping systems to consider. These issues include the following:

- In many cases the homeowner does not fully appreciate, nor understand the limitations of the pump. As a result, maintenance is frequently ignored or abandoned and the first sign of a system failure is usually a sewage spill either in the yard or in the house. To help mitigate this problem many municipalities require that all private systems have emergency overflow tanks and high liquid level alarms.
- Unlike a gravity system, a pumped system has zero surplus capacity. If a land use change or density change takes place that was not anticipated during design, the entire system becomes over-loaded.
- Residents must take precautions to ensure that materials and objects that can clog or damage the pump do not enter the system.
- Most pressure systems incorporate the use of only one pump for each private system. If a pump fails, a replacement pump must be obtained while repairs are carried out. This can present the homeowner with a serious and costly logistics problem.
- A power failure will have a serious impact on the system. Emergency maintenance measures will be required to pump out the holding tanks to prevent back-flow into the houses.
- Each pump station should be equipped with an air vent and odour problems can result. In some cases, municipalities have mandated that all air vents must outlet above the roofline elevation to address this problem.
- After repeated failures, there is the distinct possibility that homeowners will bring pressure on politicians and staff to have the municipality take over ownership and maintenance of the pump systems.

2.2 Gravity System

In this option, sewage from the house flows by a gravity service to a main in the road (or easement along the back of the lots). The sewage then flows by gravity through a system of sewer mains and manholes. Access to the service pipes is provided through sewer cleanout chambers that are situated on each property line, and for the mains, through the manholes. Mains should be installed in straight

alignments between manholes to ensure that any blockage in the pipe can be readily accessed.

Topographic conditions dictate where and in what direction the sewage will flow. Pipes must be installed with a minimum slope to maintain a sewage velocity sufficient to ensure that solids are not deposited in the pipes. These requirements can result in deep main installations, resulting in high capital costs in areas where the topography does not suit a gravity system.

Alternatively, mainline sewage pump stations can be constructed to direct the flow from low points in the system. These stations are owned and maintained by the municipality. The implications of construction costs and ongoing operation and maintenance requirements for the municipality dictate that the use of mainline pump stations should be minimized in a gravity collection system.

The use of a gravity collection system requires residential pump stations only where specific homes cannot be provided with a gravity service to the main. For the remaining gravity services, residents are responsible for ensuring that their sanitary pipe is maintained (i.e. no root penetration or pipe failures) while the municipality is responsible for maintaining the sewer mains and manholes. Gravity systems in which no pump stations are required are not affected by power disruptions.

2.3 Summary of Alternatives

Low pressure collection systems area typically employed in cases when the use of a gravity collection system is not feasible or presents a significant increase in cost. The use of a low pressure system will reduce the public health risk compared to continued use of failing septic systems, however the risk is still higher when compared to the use of a gravity collection system.

3.0 FRAMEWORK OF ANALYSIS

Based on the alternatives described in Section 2, several options for providing sanitary sewer service to the study area can be developed.

The economic evaluation of the servicing concepts considers the installation costs and the ongoing operation and maintenance costs. This approach provides for a more comprehensive accounting of the costs and aids in selecting the preferred servicing option.

3.1 Sub-Areas

The study area is divided into sub-areas that reflect the variations in topography, lot sizes, lot configurations and proposed sewer alignments. The configuration of the sub-areas is not consistent for all options, to reflect the varied sewer main alignments.

3.2 Capital Costs

The estimates of installation costs account for capital works expenditures required to construct the sewage collection system. The capital works include clearing and grubbing, installation of mains, manholes, services, pump systems and restoration of all disturbed areas.

The capital cost are determined for each presented option and a cost per lot has been provided. All costs are Class C (refer to Appendix A for definition of estimate classes) for construction, engineering and contingencies but do not include legal costs, GST, financing, inflation or similar costs. Costs are in 2001 Canadian dollars. The assumptions and calculations associated with these costs are provided in Appendix B.

The estimates do include the legal survey and easement registration costs to reflect the additional expenditures related to selecting main alignments that will lie on private property. It has been assumed that property owners will not require compensation for having an easement on their property.

3.3 Operation and Maintenance Costs

The operation and maintenance cost analysis identifies the anticipated expenditures that will be borne by the property owners. The operation and maintenance will vary from residence to residence, depending on the type of service connection (i.e. gravity, low pressure pump system).

A present value analysis for operating and maintenance costs over a 20 year period has been conducted. Present value analysis is a technique commonly used to relate costs and earnings that will be realized over a period of time. The cash flow is converted into present dollars to account for the changing value of money over time (i.e. a dollar 20 years from now is worth less than a dollar today). Therefore, the estimated costs and savings that will be realized over the 20 year time frame of this

analysis are converted to their present day value. In this way, alternatives that incorporate varied costs at different times can be compared.

Anticipated operation and maintenance costs for each type of servicing option has been calculated for inclusion in the overall analysis. These calculations are included in Appendix C. A summary of these calculations are presented following:

1) STEP Service

Costs include the following:
- Hydro cost to operate the pump
- Annual maintenance of the pump and control panel
- Cost to pump the septic tank every 3 years (local septic pumping business has indicated that if a large number of septic tanks can be pumped during the same visit, cost be reduced by approximately half. It has been assumed that such a program will be developed by the residents when calculating the maintenance costs)
- Replacement of the pumps (year 10 and year 20)

The present value of operation and maintenance costs over a 20 year period is estimated to be $3,200.

2) Residential Pump Station Service with Solids-Handling Pump

Costs include the following:
- Hydro cost to operate the pump
- Annual maintenance of the pump and control panel
- Replacement of the pumps (year 10 and year 20)

The present value of operation and maintenance costs over a 20 year period is estimated to be $3,000.

3) Residential Pump Station with Grinder Pump

Costs include the following:
- Hydro cost to operate the pump
- Annual maintenance of the pump and control panel
- Replacement of the pumps (year 10 and year 20)

The present value of operation and maintenance costs over a 20 year period is estimated to be $5,000.

It is important to note that no allowance has been made to account for system failures as part of this analysis as these are unpredictable and will vary upon the quality of equipment employed and the level of maintenance practiced. The cost of failure can be quite high when property damage, pump trucks and clean-up is factored in.

4) Gravity Service

No residential operation or maintenance costs have been included as little maintenance that must be borne by the residents having gravity service is anticipated.

4.0 ANALYSIS

This section presents an analysis of feasible servicing concepts. Five options have been produced, with each option divided into sub-areas. The five options are as follows:

1. Septic Tank Effluent Pumping (STEP) System
2. Residential Pumping System
3. Gravity System, with one sub-area the same as the 1993 study
4. Gravity System utilising road rights-of-way on Racing Road and Dennis Road
5. Combination System

4.1 Option 1 – STEP System

The conceptual layout for this option is outlined in Figure 4.1. Force mains are within road rights-of-way, therefore no easements are required. Preliminary layout and sizing of the system is based on the United States Environmental Protection Agency (EPA) manual entitled *Alternative Wastewater Collection Systems*. Based on the guidelines, it was determined that the existing downstream collection system has sufficient capacity to convey the additional sewage flow.

The pump station only pumps liquid waste from the septic tank, therefore the pipes are relatively small compared with a gravity system. Inspection chambers and manholes are not required with this system. The mains and services for this system can follow the ground profile at a 2.2 m bury.

For this analysis it has been assumed that each property owner will be responsible for the purchase, installation, operation and maintenance of the infrastructure on their property. This will eliminate the need to provide access to the septic tank, pump and controls for maintenance by City crews on private property, but access will still be needed for a private maintenance contractor. The capital cost for the work on private property has been included in the total cost.

The estimated capital cost for Option 1 is $1,576,600. Based on 108 lots, this translates to a cost of $14,600 per lot. As indicated in Section 3, the 20 year present worth of operation and maintenance costs is estimated as $3,200 per lot. Therefore, the total cost per lot is estimated as $17,800.

4.2 Option 2 – Residential Pump Station System

The layout of the low pressure collection system is similar to the STEP system, as shown on Figure 4.1. While the layout is the same, there are differences in the cost to purchase and install the residential pumping systems and with the related operation and maintenance costs.

As with the STEP system option, it has been assumed that each property owner will be responsible for the purchase, installation, operation and maintenance of the infrastructure on their property.

The anticipated capital cost for Option 2 is $1,688,800. Based on 108 lots, this translates to a cost of $15,600 per lot. As previously discussed, there are two possible pump system options; solids handling and grinder pump pump. The 20 year present worth of operation and maintenance costs is estimated as $3,000 and $5,000 per lot for the solids-handling pump and grinder pump options respectively. Therefore, the total cost per lot is estimated as $18,600 to $20,600.

4.3 Option 3 – Gravity System (Sub-Area 1 = Original Study Area)

The initial study completed in 1993 by L&M Engineering Ltd. investigated gravity collection options for the area denoted in Figure 1.1. That analysis established that the use of deep gravity mains, with no mainline pump stations, was the most economical option. Specifically, the previous study developed what was identified as Option B, which requires three lots to be serviced by pumps (lots 24, 25 and 26) and an easement in the backyards of the private properties to provide a sewer right-of-way for mains not within the road right-of-way. As the current study reviews a larger collection area, this previous plan has been incorporated to develop an overall gravity sewer collection option. The conceptual layout for this option is outlined in Figure 4.2.

Option 3 is predominantly a gravity system with a low pressure pump station installed on lots where gravity service is not feasible. When considering the estimates developed for the first three options, the most economical low pressure system is the STEP system. Therefore, for the purpose of this study, it has been assumed that the low pressure system and the individual services will employ STEP system technology. However, any house that must pump directly into a gravity main has the option to install a residential pump station.

Detailed topographic mapping is not available for the study area and will be required to proceed with a preliminary design to confirm where gravity mains are possible. Figure 4.2 identifies where the gravity pipe will be installed at depths of 3 m or more. The increased workspace needed for construction and related increased costs to excavate deeper and re-instate more disturbed surfaces have been considered.

An estimate of sewage flows generated within the study area has been determined following criteria from the City of Quesnel Subdivision Servicing Bylaw No. 1208, 1992. Based on the requirements of the bylaw, the existing downstream collection system has sufficient capacity to convey the additional sewage flow. The conceptual design and related cost estimate includes 100 mm diameter gravity services and 200 mm diameter mains.

For the estimate it has been assumed that property owners will not require compensation for having an easement on their property. However, the legal survey and easement registration costs have been included.

The estimated capital cost for Option 3 is $1,681,500. Based on 108 lots, this translates to a cost of $15,600 per lot. Properties with a gravity service are expected to have minimal operation and maintenance costs.

Employing an assumption that all residents that require a low pressure service use STEP systems, the 20 year present worth of operation and maintenance costs for those services is estimated as $3,200 (as in Option 1). Therefore, the total cost for

those lots is estimated as $18,800 per lot. For this option it is assumed that 15 of the lots will require a low pressure service.

4.4 Option 4 – Gravity System

This option was produced to reduce the length of pipe that will not be installed within the road right-of-way as installing the pipe within back lot easements will make mainline maintenance more difficult for the City.

The conceptual layout for this option is outlined in Figure 4.3. The figure denotes the sub-areas, the zones that will require low pressure systems and where deep gravity main installation is required. Similar to the previous option, the calculation of costs is based on the use of STEP systems where low pressure systems and services are required.

As with the previous option, the conceptual design and related cost estimate includes 200 mm diameter mains, while services are 100 mm diameter. For the estimate it has been assumed that property owners will not require compensation for having an easement on their property. However, the legal survey and easement registration costs have been included.

The anticipated capital cost for Option 4 is $1,672,100. Based on 108 lots, this translates to a cost of $15,500 per lot. Properties with a gravity service are expected to have minimal operation and maintenance costs.

Employing an assumption that all residents that require a low pressure service use STEP systems, the 20 year present worth of operation and maintenance costs for those services is estimated as $3,200 (as in Option 1). Therefore, the total cost for those lots is estimated as $18,700 per lot. For this option it is assumed that 14 of the lots will require a low pressure service.

4.5 Option 5 – Combination System

The purpose of this option is to determine if a combined gravity and low pressure system, in which low pressure infrastructure is employed as required to reduce the length of deep gravity mains, can provide the most economical solution. Similar to the previous option, the calculation of costs is based on the use of STEP systems. The conceptual layout for this option is outlined in Figure 4.4.

The estimated capital cost for Option 4 is $1,451,000. Based on 108 lots, this translates to a cost of $13,400 per lot. Properties with a gravity service are expected to have minimal operation and maintenance costs.

Employing an assumption that all residents that require a low pressure service use STEP systems, the 20 year present worth of operation and maintenance costs for those services is estimated as $3,200 (as in Option 1). Therefore, the total cost for those lots is estimated as $16,600 per lot. For this option it is assumed that 59 of the lots will require a low pressure service.

5.0 REVIEW OF INVESTIGATION

The following summary outlines the issues presented in the report:

Low Pressure Pump System:

- Small diameter force mains and service lines can be installed to follow topography, eliminating deep excavations
- No easements are required
- High operation and maintenance costs
- Residents must bear risks associated with system failures
- Odour problems can exist
- Future land use and density changes may cause system overload
- Issues specific to employing a STEP system:
  - Septic tanks must continue to be pumped out
  - New homes must purchase a septic tank and use a STEP System
- Issues specific to employing a residential pump system:
  - Individual and new homeowners can elect to use a STEP service

Gravity Systems

- Terrain is not conducive for gravity service, resulting in the need for deep pipe installation
- Easements are required where mains are installed on private property
- No mechanical problems for residents having gravity services
- Few residents require low pressure services
- A survey is required to confirm if gravity sewer can be provided in some areas and how many properties will require low pressure services

Combination System

- Reduced need for deep mains
- Only one easement is required (to service Toby Rd.)
- Problems with the pumped system are the same as noted above
- A survey is required to confirm if gravity sewer can be provided in some areas and how many properties will require low pressure services
- Although capital cost is less than for gravity options, more properties require low pressure systems

The following table provides a summary of total costs as well as costs per lot:

Collection System Option	Capital Cost	Cost Per Unit Including Operation and Maintenance	Capital Cost Amortized Over 20 Years (1)
1 – STEP	$1,576,600	$17,200/unit	$100
2 – Residential Pump	$1,622,800	$18,000 to $20,000/unit	$100
3 – Gravity	$1,672,000	93 units at $15,500 each 15 units at $18,700 each	$100
4 – Gravity	$1,663,600	94 units at $15,400 each 14 units at $18,600 each	$100
5 – Combination	$1,421,500	49 units at $13,200 each 59 units at $16,400 each	$90

(1) calculated using 5% interest rate and monthly payments

6.0 DISCUSSION AND RECOMMENDATIONS

Although the capital costs related to constructing a predominantly gravity collection system are greater than for low pressure systems, a full cost accounting indicates that a gravity collection system will provide the least cost for the majority of residents within the study area. Based on conceptual designs for gravity collection systems to serve the study area, very few residents would require low pressure services.

The advantage of employing a gravity system is magnified when considering the risk the property owners must bear with regards to system failure. As well, the gravity system presents less public health risk than low pressure systems due to the fact that no maintenance is required by residents and that the probability of having a system backup is much less.

The economic analysis indicates that Option 5, the combination system, results in a capital cost that is less than gravity system options. However, more than half the properties require low pressure services and those residents would be required to pay more overall costs than if they were provided with a gravity service. These people would also assume the health and operational risks.

Therefore, the City should consider constructing a gravity sewer system wherever possible within the study area. The final selection of which gravity system configuration will be determined by the interest of the property owners to be put on municipal sewer service. Some area residents may not want sewer service at this time. As well, construction of the sewer system can be implemented in phases, over a period of time, as the need arises from various sub-areas. It is recommended that the City undertake a review of this study with the residents of the study area to ascertain their view of collection system options and their commitment to carry forward the infrastructure improvements.

In this study it has been identified that the use of a gravity collection system can still require that some properties install low pressure services. It is recommended the City develop a bylaw to outline the requirements of STEP and residential pump systems for the entire municipality. This bylaw should address issues such as the need for high liquid level alarms, overflow tanks and the placement of air vents. The need to mandate the timing of pumping out septic tanks in a STEP system should also be dealt with.

There are known health problems that are attributed to failing septic systems in the study area. The elimination of public health risks is a priority issue for the province and is eligible for funding through the Local Government Infrastructure Grant. The City should investigate this opportunity, as funding of 25% and perhaps up to 50% of the capital cost may be possible. Appendix E provides a breakdown of the costs based on these levels of funding.

7.0 REFERENCES

Urban Systems acknowledges the review and application of the following documents during the preparation of this report:

- City of Quesnel Subdivision Servicing Bylaw No. 1208, 1992.
- L & M Engineering Ltd. : Proposed Extension of Red Bluff Sewer System Feasibility Study, 1993 and 1994 Update, for The Cariboo Regional District.
- United States Environmental Protection Agency – Alternative Wastewater Collection Systems

CITY of
QUESNEL

SOUTH HILLS
SEWER
EXTENSION

FEASIBILITY STUDY

APPENDIX A

Letter from Public Health Officer

File: 7119049.1
December 2001

URBANSYSTEMS.

CITY of
QUESNEL

SOUTH HILLS
SEWER
EXTENSION

FEASIBILITY STUDY

APPENDIX B

Classes of Cost Estimates

File: 7119049.1
December 2001

URBANSYSTEMS.

CITY of
QUESNEL

SOUTH HILLS
SEWER
EXTENSION

FEASIBILITY STUDY

APPENDIX C

Capital Cost Estimates

File: 7119049.1
December 2001

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QUESNEL

SOUTH HILLS
SEWER
EXTENSION

FEASIBILITY STUDY

APPENDIX D

Operation and Maintenance Cost Estimates

File: 7119049.1
December 2001

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SOUTH HILLS
SEWER
EXTENSION

FEASIBILITY STUDY

APPENDIX E

Summary of Costs – Considering Funding

File: 7119049.1
December 2001

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CITY OF QUESNEL

SOUTH HILLS SEWER EXTENSION
FEASIBILITY STUDY

ENGINEER'S ESTIMATE - CLASS C
OPTION 4 : GRAVITY SYSTEM

Item	Description	Unit	Estimated Quantity	Unit Price	Total
	SUB-AREA 1				
1	Clearing and Grubbing (0.4 ha.)	LS			$ 2,400
2.1	200mm PVC Gravity Sewer Main incl. Sand Bedding, <	m	660	$ 90	$ 59,400
2.2	200mm PVC Gravity Sewer Main incl. Sand Bedding, >	m	250	$ 150	$ 37,500
3	1050mm Manholes	each	10	$ 4,500	$ 45,000
4	100mm PVC Gravity Sewer Service	m	730	$ 60	$ 43,800
5	100mm PVC Gravity Sewer Service Inspection Chamber	each	32	$ 200	$ 6,400
6	Yard Restoration	each	21	$ 500	$ 10,500
7	Road Restoration	m²	2,600	$ 30	$ 78,000
8	Pipeline Crossing	each	2	$ 10,000	$ 20,000
	SUB-TOTAL				**$ 303,000**
	Engineering and Contingency , 35% (Rounded)				$ 106,000
	SUB-TOTAL				**$ 409,000**
	7% GST (Rounded)				$ 29,000
	TOTAL SUB-AREA 1				**$ 438,000**
	SUB-AREA 2				
1	Clearing and Grubbing (0.4 ha.)	LS			$ 2,000
2.1	200mm PVC Gravity Sewer Main incl. Sand Bedding, <	m	940	$ 90	$ 84,600
2.2	200mm PVC Gravity Sewer Main incl. Sand Bedding, >	m	160	$ 150	$ 24,000
3	1050mm Manholes	each	10	$ 4,500	$ 45,000
4	100mm PVC Gravity Sewer Service	m	730	$ 60	$ 43,800
5	100mm PVC Gravity Sewer Service Inspection Chamber	each	33	$ 200	$ 6,600
6	Yard Restoration	each	22	$ 500	$ 11,000
7	Road Restoration	m²	2,100	$ 30	$ 63,000
	SUB-TOTAL				**$ 280,000**
	Engineering and Contingency , 35% (Rounded)				$ 98,000
	SUB-TOTAL				**$ 378,000**
	7% GST (Rounded)				$ 26,000
	TOTAL SUB-AREA 2				**$ 404,000**

CITY OF QUESNEL

SOUTH HILLS SEWER EXTENSION
FEASIBILITY STUDY

ENGINEER'S ESTIMATE - CLASS C
OPTION 4 : GRAVITY SYSTEM

Item	Description	Unit	Estimated Quantity	Unit Price	Total
	SUB-AREA 3				
1	Clearing and Grubbing (0.1 ha.)	LS			$ 500
2.1	200mm PVC Gravity Sewer Main incl. Sand Bedding, <	m	250	$ 90	$ 22,500
2.2	200mm PVC Gravity Sewer Main incl. Sand Bedding, >	m	140	$ 150	$ 21,000
3	1050mm Manholes	each	5	$ 4,500	$ 22,500
4	100mm PVC Gravity Sewer Service	m	270	$ 60	$ 16,200
5	100mm PVC Gravity Sewer Service Inspection Chamber	each	13	$ 200	$ 2,600
6	25mm PE Series 100 Pressure Sewer Service - 2.5m deep	m	180	$ 40	$ 7,200
7	25mm Residential Pump Station Package	each	5	$ 4,000	$ 20,000
8	Residential Pump Station Electrical Connection	each	5	$ 500	$ 2,500
9	Yard Restoration	each	13	$ 500	$ 6,500
10	Road Restoration	m²	1,200	$ 30	$ 36,000
	SUB-TOTAL				**$ 157,500**
	Engineering and Contingency , 35% (Rounded)				$ 55,000
	SUB-TOTAL				**$ 212,500**
	7% GST (Rounded)				$ 15,000
	TOTAL SUB-AREA 3				**$ 227,500**
	SUB-AREA 4				
1.1	200mm PVC Gravity Sewer Main incl. Sand Bedding, <	m	290	$ 90	$ 26,100
1.2	200mm PVC Gravity Sewer Main incl. Sand Bedding, >	m	150	$ 150	$ 22,500
2	1050mm Manholes	each	5	$ 4,500	$ 22,500
3	100mm PVC Gravity Sewer Service	m	230	$ 60	$ 13,800
4	100mm PVC Gravity Sewer Service Inspection Chamber	each	11	$ 200	$ 2,200
5	Yard Restoration	each	7	$ 500	$ 3,500
6	Road Restoration	m²	800	$ 30	$ 24,000
	SUB-TOTAL				**$ 114,600**
	Engineering and Contingency , 35% (Rounded)				$ 40,000
	SUB-TOTAL				**$ 154,600**
	7% GST (Rounded)				$ 11,000
	TOTAL SUB-AREA 4				**$ 165,600**

CITY OF QUESNEL

SOUTH HILLS SEWER EXTENSION
FEASIBILITY STUDY

ENGINEER'S ESTIMATE - CLASS C
OPTION 4 : GRAVITY SYSTEM

Item	Description	Unit	Estimated Quantity	Unit Price	Total
	SUB-AREA 5				
1	Clearing and Grubbing (0.2 ha.)	LS			$ 1,600
2.1	200mm PVC Gravity Sewer Main incl. Sand Bedding, <	m	380	$ 90	$ 34,200
2.2	200mm PVC Gravity Sewer Main incl. Sand Bedding, >	m	270	$ 150	$ 40,500
3	1050mm Manholes	each	7	$ 4,500	$ 31,500
4	100mm PVC Gravity Sewer Service	m	440	$ 60	$ 26,400
5	100mm PVC Gravity Sewer Service Inspection Chamber	each	10	$ 200	$ 2,000
6	50mm PVC Series 100 Pressure Sewer Main - 2.5m deep	m	200	$ 50	$ 10,000
7	25mm PE Series 100 Pressure Sewer Service - 2.5m deep	m	420	$ 40	$ 16,800
8	25mm Residential Pump Station Package	each	6	$ 4,000	$ 24,000
9	Residential Pump Station Electrical Connection	each	6	$ 500	$ 3,000
10	Yard Restoration	each	14	$ 500	$ 7,000
11	Road Restoration	m²	3,500	$ 30	$ 105,000
	SUB-TOTAL				**$ 302,000**
	Engineering and Contingency , 35% (Rounded)				$ 106,000
	SUB-TOTAL				**$ 408,000**
	7% GST (Rounded)				$ 29,000
	TOTAL SUB-AREA 5				**$ 437,000**
	TOTAL CAPITAL COST FOR OPTION 4				**$ 1,672,100**

October 22, 2001 Job Number: 900

City of Quesnel
405 Barlow Avenue
Quesnel, BC, V2J 2C3

Attention: Jack Marsh
Director of Public Works and Engineering

Reference: WATER SERVICE TO LANDFILL AREA

A review of the proposed water main extension to service to the landfill area has been completed and preliminary cost estimates have been prepared. The water would be supplied from the Dragon Hill reservoir, as outlined in the figure below.

There has been discussion as to the provision of a water service to the Cariboo Pulp and Paper Co. At this time the need and the timing of the construction of that water service is uncertain. Therefore, the estimates included in this letter exclude the water service to the mill.

It is understood that United Concrete has plans to construct a 1,000 m^2 shop complete with approximately one half of the building having a second floor. Initial calculations have indicated that the required fire flow for this building is 150 L/s. However, if this building included the installation of sprinklers, the

ability to reduce the required fire flow to less than 100 L/s is anticipated. These fire flows should be reviewed at the preliminary design stage.

The following table identifies the estimated costs associated with providing fire flows of 150 and 100 L/s:

Fire Flow	Water Main Diameter	Estimated Construction Cost
150 L/s	300 mm	$730,000
100 L/s	250 mm	$660,000

If a 150 mm diameter water main were selected, the anticipated construction cost would be in the order of $540,000. However, the preliminary water model indicates that a fire flow of only 25 L/s would be available at the United Concrete property.

I trust that this letter sufficiently outlines the cost associated with providing water service to the landfill area. Please feel free to contact me if you would like to discuss this issue further.

Yours truly,

URBAN SYSTEMS LTD.

Rick Collins, EIT
Project Engineer

COST ESTIMATE

OWNER: CITY OF QUESNEL
PROJECT: SERVICE CARIBOO PULP & PAPER
ESTIMATE DESCRIPTION: SERVICE VIA CARSON PIT RD. AND SWORD AVE. - SCENARIO 5 AND 6

Item	Description	Unit	Estimated Quantity	Unit Price	Total Amount
1.0	Mobilization & Demobilization	LS	1	$ 8,000	$ 8,000
2.0	Survey Layout	LS	1	$ 6,000	$ 6,000
3.0	Site Preparation Including:				
	3.1 Asphalt Removal	LS	1	$ 7,000	$ 7,000
	3.2 Locate Existing Infrastructure	LS	1	$ 4,000	$ 4,000
4.0	Watermains c/w Imported Granular Pipe Bedding (all depths)				
	4.1 PVC Watermains				
	.1 200 mm PVC DR 18 Watermain	m	1300	$ 140	$ 182,000
	.2 250 mm PVC DR 18 Watermain	m	1000	$ 160	$ 160,000
	.3 200 mm (Mill main upgrade) - Class 200 pipe	m	100	$ 160	$ 16,000
	4.2 Tracer Wire on PVC Pipe				
	.1 #12 AWG Solid Strand Copper Wire	m	2300	$ 1	$ 2,300
	.2 Monitoring Stations @ 300 m Intervals	ea	8	$ 500	$ 4,000
	4.4 Chlorination & Disinfection	LS	1	$ 3,000	$ 3,000
5.0	Miscellaneous Valves and Fittings				
	5.1 200 F x H Resilient Wedge Gate Valve	ea	3	$ 1,200	$ 3,600
	5.2 250 F x H Resilient Wedge Gate Valve	ea	3	$ 1,400	$ 4,200
	5.2 Class 350 Fittings c/w Assembly				
	.1 200 H X H 22 1/2° Bend	ea	2	$ 500	$ 1,000
	.2 200 H X H 45° Bend	ea	2	$ 500	$ 1,000
	.3 250 H X H 22 1/2° Bend	ea	3	$ 600	$ 1,800
	.4 250 H X H 45° Bend	ea	3	$ 600	$ 1,800
	5.3 End Cap c/w 50 mm FIP Tap	ea	2	$ 900	$ 1,800
6.0	Air Release Valves and Chambers	ea	2	$ 3,300	$ 6,600
7.0	Flush Out Assembly	LS	2	$ 3,000	$ 6,000
8.0	Fitting and Valve Combinations				
	8.1 200 mm Tee and 200 GV Combination	ea	1	$ 3,600	$ 3,600
	8.2 250 mm Tee and 250 GV Combination	ea	1	$ 4,200	$ 4,200
9.0	Connection to Existing Main/Reservoir	LS	1	$ 5,000	$ 5,000
10.0	Tie-in to Mill Water System Including Backflow Preventer, Pressure Reducing Valve, Flow Meter and Temporary Bypass	LS	1	$ 45,000	$ 45,000
11.0	Terminal City C71P Fire Hydrants	ea	15	$ 5,100	$ 76,500
12.0	Service Connections				
	12.1 Water Services				
	- 25 mm	ea	2	$ 1,500	$ 3,000
	- 50 mm	ea	2	$ 2,000	$ 4,000

COST ESTIMATE

OWNER: **CITY OF QUESNEL**
PROJECT: **SERVICE CARIBOO PULP & PAPER**
ESTIMATE DESCRIPTION: **SERVICE VIA CARSON PIT RD. AND SWORD AVE. - SCENARIO 5 AND 6**

Item	Description	Unit	Estimated Quantity	Unit Price	Total Amount
13.0	Restoration and Cleanup				
13.1	Topsoiling and Hydroseeding	LS	1	$ 6,000	$ 6,000
13.2	Paved Road Repair	m²	2500	$ 30	$ 75,000
13.3	Gravel Road Repair	m²	2400	$ 12	$ 28,800
13.4	Boulevard and Driveway Restoration	LS	1	$ 10,000	$ 10,000
13.5	Mill Restoration (Due to Main Replacement)	LS	1	$ 10,000	$ 10,000
14.0	Provisional Items				
14.1	50 mm Styrofoam HI-60 Insulation Over Watermain Sections Less Than 2.2 m Earth Cover	m²	5	$ 20	$ 100
14.2	Culverts				
	.1 Removal of Existing Culverts	ea	5	$ 200	$ 1,000
	.2 Reinstallation of Existing Culverts	ea	2	$ 210	$ 420
	.3 Suppy and Install Culverts	ea	3	$ 540	$ 1,620
14.3	Over Excavation Removal and Disposal of Unsuitable Soils	m³	100	$ 8	$ 800
14.4	Imported Drain Rock Pipe Bedding	m	100	$ 10	$ 1,000
14.5	Imported Trench Backfill	m³	400	$ 8	$ 3,000
14.6	50 mm Saddles to Facilitate Testing	ea	2	$ 400	$ 800

SUB-TOTAL	**$**	**699,940**
35% Engineering and Contingency	$	244,979
SUB-TOTAL	**$**	**944,919**
7% GST	$	66,144
TOTAL PROGRESS AMOUNT	$	1,011,063

City of Quesnel

Extension of Municipal Water Service

Feasibility Study

1190.0100.01 / February 2005

URBAN SYSTEMS
PLANNERS • ENGINEERS • LANDSCAPE ARCHITECTS
#200 – 286 St. Paul Street
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TABLE OF CONTENTS

APPENDICES

EXECUTIVE SUMMARY

The City of Quesnel is presently considering the system modifications and costs associated with assuming ownership of the DVC Developments Ltd. potable water supply and distribution system, (henceforth referred to as the DVC water system). The residents residing in the Valhalla/Jason Place/Richards Roads area (henceforth referred to as the Richards Road area), who are part of a "good neighbour" water system have also approached the City regarding the feasibility of connecting to the municipal water system. Providing water service to residents on private wells in the Westland Rd. area is also considered. 174 properties make up this study area, of which 118 homes exist.

This investigation is based on technical analysis of the existing municipal system and available information related to the two existing private water systems. This feasibility study included:

- assessment of DVC Developments Ltd. water distribution system
- review of requirements to service the study area
- estimate of capital costs

There are various concerns with continuing to operate the private systems, especially from public health, safety and sustainability standpoints. There are public health concerns with respect to water quality, public safety concerns related to inadequate fire protection and sustainability issues as there are no long-term operations, maintenance or financial plans for the private systems. The owners of the DVC utility and the "good neighbour" system have both provided written confirmation that the future of those systems are in question and that it would be in the best interest of the area residents for the City to provide potable water.

It is recommended that ownership of the DVC Developments Ltd. water utility infrastructure be transferred to the City and the private utility be dissolved. It will result in abandoning the existing private water supply and storage infrastructure and making water main connections to the municipal system. Hydraulic analysis indicates that the majority of the existing DVC water system piping can be maintained in service.

Due to the substandard state of the other area water infrastructure, it should be completely abandoned.

The extension of municipal water service has been divided into two phases. Phase 1 includes servicing the Richards Road area as well as transferring ownership and upgrading the DVC area. Phase 2 ties the DVC and Municipal systems together in the Westland area.

The estimated capital cost for Phase 1 is $1,513,000 and for Phase 2 is $684,000. It is important to note that any works on private property are not the City's responsibility and are not included in this assessment or the capital cost estimates. Costs for additional investigations and administrative duties would also be in addition to the estimates presented in this report.

1.0 INTRODUCTION

The owner of the DVC Developments Ltd. private water utility has approached the City in hope of having the municipality provide potable water to the utility customers. The City is presently considering the system modifications, costs and financial strategy associated with assuming ownership of the DVC Developments Ltd. potable water supply and distribution system, (henceforth referred to as the DVC water system) as presented in Figure 1.

The residents residing in the Valhalla/Jason Place/Richards Roads area (henceforth referred to as the Richards Road area) have also approached the City regarding the feasibility of connecting to the municipal water system. Figure 1 also displays the extents of that potential service area.

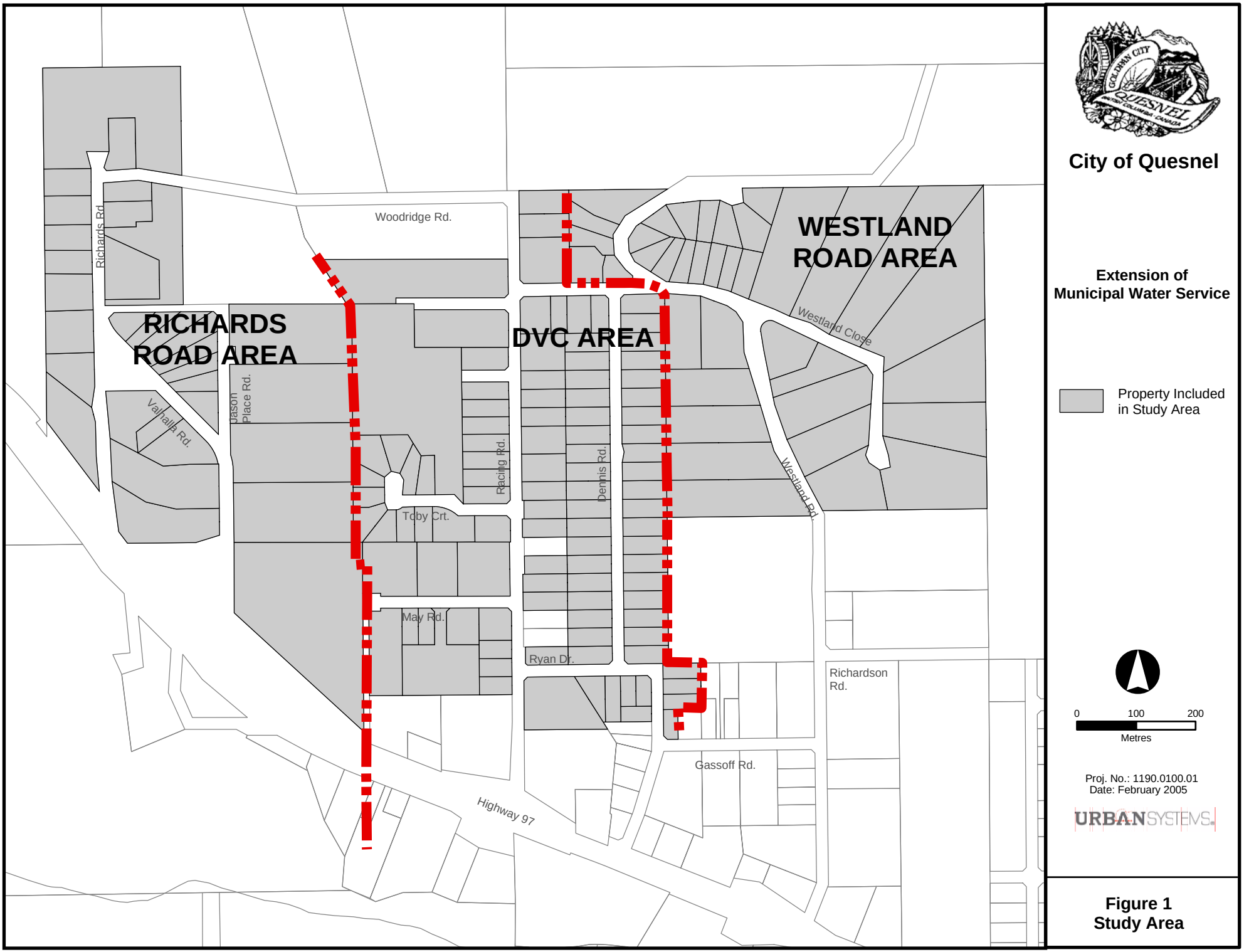
The City has confirmed the need and the feasibility of providing municipal water service to the residents of this study area. Aspects of this investigation included:

- Assessment of DVC Developments Ltd. water distribution system
- Review of requirements to service the study area
- Estimate of capital costs

The review at this stage is based on technical analysis of the existing municipal system and available information related to the two existing private systems, including:

- DVC Developments Ltd. System
  - Record drawings, as provided by DVC Developments Ltd., of the existing trunk main, supply and reservoir system.
  - Discussion with City Public Works staff (source of some of their information was based on discussions with the area residents and the utility owner)
- Richards Road System
  - Discussion with City Public Works staff (source of some of their information was based on discussions with the area residents and the system owner)

The City intends to enlist the services of the City Utilities Department to undertake field testing of the DVC water system this spring. That testing is vital to assess the viability of employing the existing DVC area distribution system.



City of Quesnel

Extension of Municipal Water Service

Property Included in Study Area

0 100 200
Metres

Proj. No.: 1190.0100.01
Date: February 2005

URBAN SYSTEMS

Figure 1
Study Area

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2.0 SERVICE AREA DESCRIPTION

2.1 Existing Municipal Water Distribution System

The majority of the developed area within the municipal boundaries in South Quesnel is serviced by the municipal water system. Supply is provided by ground water wells, located near the banks of the Fraser and Quesnel rivers. Water is delivered to South Quesnel via the North Star Booster Station and trunk water main.

Bruce Gant, Drinking Water Leader for the Northern Health Region has indicated that the City's water system is considered low risk with regards to health risk. The City is proactive in managing the water system to ensure acceptable water quality for the community. Recently the City adopted new drinking water protocols by implementing a City-wide water quality testing and monitoring program.

The City's water system can meet the added demands of the study area without initiating increases in reservoir storage, booster station upgrades or trunk main extensions. These municipal utility upgrades would not be required as the system was designed and constructed to accommodate some degree of system expansion and related demand increases. Servicing the study area is a key component of providing the excess capacity. The community has recognized the need to provide municipal water supply to the study area as noted in Section 14.3 of Quesnel's Official Community Plan where it states it is Council's policy to "continue to investigate the feasibility, alternatives, and costs of extending City of Quensel community water services to the Racing / Westland Road area, and continue to consult with residents on their desire to see community water in this area".

2.2 DVC Developments Ltd. Water System

As-built records indicate that the water system was constructed in 1981. The water supply well pumps directly into a concrete reservoir. A booster station delivers water from the reservoir to the distribution system. Supply to the area is not possible during a power outage.

The design drawings indicate that the system serves the residents in the Racing Rd. and Dennis Rd. area. The City is also aware of subsequent extensions to service residents on Toby Crt. There is also anecdotal evidence that some service connections have been extended to properties

to the west of the original service area. The number or location of all service connections is not known at this time.

2.3 Richards Rd. Water System

The water system that presently serves the Richards Rd. area consists of a single well, complete with submersible pump, and small diameter distribution system. The system provides water service to most residences in the area; no capacity for fire protection has been included in the system.

At this time, it is presumed that the Richards Rd. water system is not a formal utility as no registration with the Comptroller of Water Rights is on record. It is more likely that it is a "good neighbour" system, meaning that service from the well was extended to neighbouring properties outside of a provincially regulated forum. Based on communications with the area residents, it is understood that at least 8 service connections exist. This number of connections is not viewed favourably as it is "beyond the spirit" of the good neighbour system.

2.4 Westland Area

An outline of the Westland area can be found in Figure 1. The residents of this area are currently served by individual groundwater wells.

3.0 CONCERNS REGARDING THE PRIVATE SYSTEMS

There are various concerns with continuing to operate the private systems, especially from public health, safety and sustainability standpoints. There are public health concerns with respect to water quality, public safety concerns related to inadequate fire protection and sustainability issues as there are no long-term operations, maintenance or financial plans for the private systems.

3.1 Public Health

Residents in the study area are currently consuming water of unknown quality. Water quality monitoring has not been completed in the DVC area since 2003 and water quality is not monitored for residents of the Richards Road area. It is also unlikely that regular monitoring occurs for all private water wells in the Westland area.

Water quality records for the DVC system indicate that the water quality has historically been acceptable. However, system conditions warrant a concern regarding ongoing water quality. As an example, the water level is kept below designed operating levels in the reservoir as biofilm has built up on the walls above that level. There are also public health concerns as the operators of both systems are not properly qualified as required in the Drinking Water Protection Act. Furthermore, Emergency Response Plans do not exist for either system.

There are also concerns related to the water quality of the DVC water supply. The water is very hard and high in iron. The following table provides a summary of the 2003 water quality results compared to the guidelines included in the *Summary of Guidelines for Canadian Drinking Water Quality (03/01).* For comparison purposes, the table also includes the results of water testing for the new well the City completed in 2005. This new City well will provide the majority of supply to the study area.

Parameter	Guideline (mg/L)	DVC Supply (mg/L)	New City Well (mg/L)
Iron	<= 0.3	0.9	0.269
Hardness	< 200 considered poor 500 considered unacceptable	462	109

3.2 Public Safety

Adequate fire protection is not provided to the residents within the study area.

The fire pump for the DVC water system is in disrepair and appropriate hydrant maintenance practices have not been undertaken for several years. The DVC water system booster pump does not even have 10% of the capacity necessary to provide suitable fire flow protection to the residential area (i.e. 75 L/s) capacity. The reservoir cannot provide gravity supply to the system and, as noted above, does not store the designed storage volume. Insurance providers do not consider homes within the DVC area as being within a fire protection area. Residents serviced by the DVC System are without adequate fire protection.

Likewise, the residents within the Richards Road and Westland areas are not in fire protection areas as these systems were not designed for that capacity.

3.3 Sustainability

There are clear concerns related to the sustainability of the two private systems. The ability of the system owners to operate, maintain and repair their systems, especially in emergency situations is questionable. No operating training or certification exists for the water systems. It is also understood that regular water sampling and testing is not undertaken.

Review of the Northern Health Region operating records indicates that the DVC Developments Ltd. has not completed any water quality testing in over two years. Testing prior to that time was only completed as the Drinking Water Officer at the time conducted this work as a service to the community. Records also indicate that the utility owner has been delinquent on paying the operating permit fee since 2003.

In the summer of 2004, the DVC System experienced a supply failure. Unfortunately for the residents in the service area, the owner of the system did not have sufficient resources to make the necessary repairs. The City of Quesnel did come to the aid of its residents to fund and undertake the repairs, despite the high degree of potential liability assumed by working on a private system.

The utility owner is not operating or maintaining the water system in a sustainable manner. As further proof, DVC Developments Ltd. wrote a letter to the City expressing it is no longer in the

best interest of the private system users to continue being serviced by the private utility. A copy of this letter can be found in Appendix A.

The "good neighbour" system, currently serving residents of the Richards Road Area, is without plans with respect to operations, maintenance and emergency response. In March of 2003, the owner of the Richards Road system wrote a letter to its users indicating it could no longer financially and physically provide water service. This letter was followed by a survey of nearly 20 property owners, all of which indicating an interest in obtaining water service from the City. A copy of the survey and letter can be found in Appendix A. Furthermore, it is believed that a reserve fund does not exist for this water system. Therefore, the users of this system may easily find themselves without water if issues with water supply or distribution arise, or if the owner simply chooses to abandon the system.

Properties that are serviced by private wells in the Westland area are reliant on single source quality and supply. No survey of the individual systems has been conducted, however, it is unlikely that regular water monitoring is occurring and no plan exists should equipment or power failure occur.

Should the private systems continue to operate, the City is not responsible to undertake any operations or maintenance duties on those systems. Consequently, the residents serviced in these areas have no assurance of the reliability and sustainability of their water supply.

4.0 SERVICING THE STUDY AREA

Extension of the City water system should be made to provide a suitable level of service to the area properties, as outlined in the City's Subdivision Servicing Bylaw, and based on sound engineering practice. The ownership of all private water system infrastructure would be transferred to the City and the private utility would cease to exist. The City would be responsible for all capital upgrades, operations, maintenance and administration duties.

Analysis of the City's water model was conducting using WaterCAD. The analysis considered system flows and pressures during the following scenarios:

- Fire flow of 75 L/s during maximum day demand period
- No demand (static pressures)
- Peak hour demands

The water system analysis identified that system upgrades can be constructed that will result in the residents being provided municipal water service within normal operating parameters. The model also indicates that, if the condition and quality of the existing DVC water mains is acceptable, they can be used as part of the eventual distribution system.

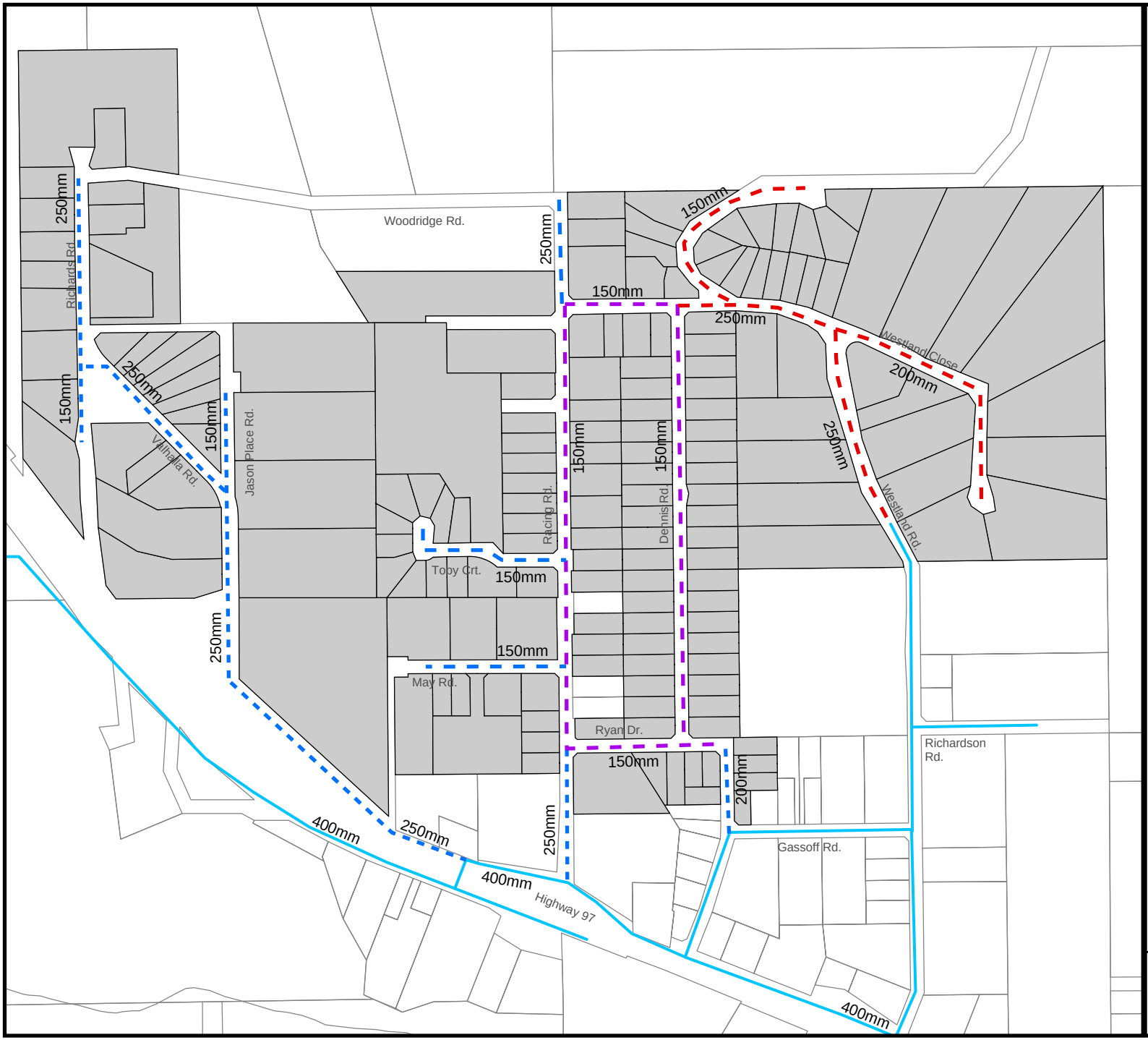
Extending the municipal water service can be considered in two phases as described below.

4.1 Phase 1 – Richards Road and DVC Areas

Phase 1 includes servicing the Richards Road and DVC areas, as presented in Figure 2. There is evidence indicating some service connections have been extended from the DVC system to properties within the Richards Road area. As a result, extending the municipal utility to only the DVC area would leave certain residents without water service. Phase 1 should include both areas.

Servicing the Richards Road area would involve decommissioning the existing well and construction of a new distribution system that extends from the existing municipal trunk main. Hydrants, mainline valves and new service connections would be required.

Servicing the DVC area would involve constructing two system connections to the existing, adjacent municipal distribution system. Abandoning the existing private well and reservoir is necessary to ensure adequate water quality. The City's water system presently has the supply



City of Quesnel

Extension of Municipal Water Service

- Proposed Water Phase 1
- Proposed Water Phase 2
- Existing City Water Mains
- Existing Private Water Mains
- Service Area

0 100 200
Metres

Proj. No.: 1190.0100.01
Date: February 2005

URBAN SYSTEMS.

Figure 2
Proposed System Layout

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and storage capacity necessary to service the entire study area. Maintaining the low yield well and small reservoir in service would only be a liability.

It is assumed that properties on Toby Crt. are serviced by a water main that is 100 mm in diameter or less. This geometry is not in adherence to accepted design practices. As well, suitable fire protection would not be provided. The system upgrade therefore includes the installation of a 150 mm main, complete with suitable mainline valves and a fire hydrant. The service connections that have been extended to properties to the west of the original DVC service area would be abandoned in this model.

It is understood that the properties on May Rd. are not connected to either private water system. If the connection of the DVC area proceeds, it is reasonable to also service these properties as the entire surrounding area would be connected to the municipal system. This investigation's model includes the servicing of May Rd. properties.

Although pressure and flow requirements can be attained for properties in the DVC area by making connection to the existing distribution system, additional upgrades of that distribution system are required.

Hydrants

The City's Subdivision Servicing Bylaw stipulates a maximum hydrant spacing in a residential area of 150 m with no residence being more than 90 m from a hydrant. These standards are not met by the DVC system. As well, while hydrants presently exist in the DVC area, at this stage the City is not aware if they all function properly. It is assumed that 3 new hydrants will need to be installed, either to increase coverage or to replace irreparable units. Additional hydrants are also recommended as part of the new water main installation to improve area coverage.

Mainline Valves

The existing DVC distribution system has too few mainline valves compared to City standards. For this investigation it has been assumed that appropriate additional mainline valves will be installed as part of installing the new hydrant service tees.

The estimated capital costs associated with Phase 1 is $1,513,000, as presented in Appendix B. Any works on private property are not the City's responsibility and are not included in this assessment or the capital cost estimates. Costs for additional investigations and administrative duties would also be in addition to the estimates presented in this report.

4.2 Phase 2 – Westland Area

Phase 2 of the municipal water extension will provide municipal water service to a number of homes while also providing a system loop between the DVC and municipal systems via Westland Road. Suitable mainline valving and hydrant installation can also be accommodated to provide adequate service to the area. Details of Phase 2 can be found in Figure 2.

Servicing the homes in this area will also involve the disconnection of the private wells to the household water systems. It is also recommended that household backflow preventers be installed to protect against system contamination.

The cost to construct and commission Phase 2 is estimated as $684,000. This estimate does not include the cost of any works on private property.

5.0 ANTICIPATED SCHEDULE

Table 1 outlines the anticipated schedule for the completion of this project within the 2005 construction season. This schedule assumes that notification of the proceeding with the project is granted by late spring.

Table 1: Anticipated 2005 Schedule

	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Creation of Local Area Bylaw	→	→					
Final Design	→						
Complete Tender Package		→					
Tender Work		→					
Award Contract			*				
Construction			→	→	→	→	
Project Completion							*

6.0 DISCUSSION

Due to issues of public health, public safety and sustainability, it is logical that municipal water service be extended to the area residents. This investment would ensure a reduced risk to residents from water borne disease, improved fire protection and a greater security of water supply. Operators of the 2 private systems within the study area agree that it would be in the best interest of the area residents if the City distribution system was extended.

The City has the potential to obtain funding from the B.C Community Water Improvement Program, provided by the Ministry of Community, Aboriginal and Women's Services. This funding program will provide 2/3 funding for capital works. It is recommended that this infrastructure investment be explored in further detail with the Ministry.

APPENDIX A

Letters and Survey Documentation

August 10, 2004

City of Quesnel,
410 Kinchant St.
V2J-7J5

Attl City Manager:

My name is Craig Stenersen and our Company operates the water system in the Racing Rd. area known as Birch Heights Estates. It has become apparent to us that it is no longer in the best interest of our Users for us to operate and maintain this system. YOUR IMMEDIATE ATTENTION TO THIS MATTER WOULD BE APPRECIATED.

I am contacting, (AND REQUEST) that you contact the Water Utilities Commission regarding this matter IMMEDIATELY. I thank you for your understanding in this matter. Please contact me on my cell as soon as you receive this letter 780-233-9939.

sincerely,

Craig Stenersen

DVC Developments Ltd.
#204-11165 70th St.
Edmonton Ab.
T5B-1S8
780-233-9939

341 Richards Rd.,
Quesnel, V2J 4S7
May 5, 2003

Attentiona: City of Quesnel Mayor and Council,
- Mr. Jack Marsh

Mr. Mayor and City Councillors:

As per my recent conversation with the above named Jack Marsh, I have done a survey of residents of Richards Road, Jason Place Road and Valhalla Road. This was to find out what interest the residents and property owners on these roads in having a meeting with the city in regards to obtaining water connection and service to these roads and residences.

I have enclosed a copy of the letter that the present water service provider and supplier has circulated to all those with residences on Richards Road. This letter indicates her intention to not continue the water supply / service as at present. She does not state when the service will be terminated.

We would be interested in a meeting at your earliest convenience. As this is of the utmost importance to all residents of the three named roads in our community, I would suggest that this be a high priority and be held as soon as possible.

I look forward to hearing from you as soon as possible, and thank you in advance for your consideration. You may contact me at 747-0074 (message). Thank you again.

Sincerely

Jack Nelson "J.B. NELSON"

Copies enclosed/ 1
4 SHEETS SURVEY FORMS.

Attention: Charles Hamilton
Copy: Jack Marsh

April, 2003

To Whom it May Concern:

We, the undersigned, would like to indicate our concern and interest in regards to obtaining water access, from the City of Quesnel, for all residences and holdings on Richards Road, Valhalla Road, and Jason Place Road.

April 9, 2003.

Titled Owners (pls. print)	House # or DL #	Attend mtg @ Jack Marsh (yes/no)	Signature
JACK & VICKI NELSON	341 RICHARDS ROAD, QUESNEL B.C	YES	Jack Nelson Victoria M Nelson
MIKE & COLLEEN LANGILLE (TENANTS)	381 RICHARDS ROAD.	YES	Mike Langille Colleen Langille
PETER & JULIE BAYMAN	361 RICHARDS ROAD.	YES	P Bayman
Elizabeth Ambery	342 Richards Rd,	yes	Elizabeth Ambery
KEVIN & DOROTHY BOYSCHAT	412 RICHARDS ROAD.	YES	Kevin Boyschat Dorothy Boyschat

Copy

Attention: Charles Hamilton
Copy: Jack Marsh

April, 2003

To Whom it May Concern:

We, the undersigned, would like to indicate our concern and interest in regards to obtaining water access, from the City of Quesnel, for all residences and holdings on Richards Road, Valhalla Road, and Jason Place Road.

Titled Owners (pls. print)	House # or DL #	Attend mtg @ Jack Marsh (yes/no)	Signature
STUART DUBUC JENNIFER GARDNER	401 RICHARDS ROAD Q.	YES	
Perry Lofstrom	451 Richards Road.	yes	
Bill McNabb Debbie McNabb	443 Richards Rd.	yes	Debbie McNabb Bill McNabb
Susan and Ross Warlow	291 Richards Road	Yes.	Susan Warlow
Bessie Murray	~~381~~ 381 Richards Rd	Yes.	Bessie Murray

Copy

Attention: Charles Hamilton
Copy: Jack Marsh

April, 2003

To Whom it May Concern:

We, the undersigned, would like to indicate our concern and interest in regards to obtaining water access, from the City of Quesnel, for all residences and holdings on Richards Road, Valhalla Road, and Jason Place Road.

Titled Owners (pls. print)	House # or DL #	Attend mtg (w Jack Marsh (yes/no)	Signature
MARGARET VOMPEL APRIL 15/03	D.L. # 6682 JASON PLACE ROAD 32008 CD PLAN. P[illegible] 3	YES.	x M. Vompel
DAN & ALICE MCKEITH	1852 VALHALLA RD V2J 4S7	YES	Alice McKeith
SIEGLINDE & KEN BENTHAM APR 19/03	1868 VALHALLA RD V2J 4S7	YES *(AS TO MEETING ONLY)	
SERGE & (OWNERS) HRBINIC	1883 VALHALLA ROAD V2J 4S7	Yes	
WOMER & HRBINIC (TENANTS)	1273 VALHALLA ROAD V2J 4S7	Yes	

Attention: Charles Hamilton
Copy: Jack Marsh

April, 2003

To Whom it May Concern:

We, the undersigned, would like to indicate our concern and interest in regards to obtaining water access, from the City of Quesnel, for all residences and holdings on Richards Road, Valhalla Road, and Jason Place Road.

Titled Owners (pls. print)	House # or DL #	Attend mtg w Jack Marsh (yes/no)	Signature
GORDON PHILLIPS	JASON PLACE ROAD 191 V2J457		Carol Phillips Gordon Phillips
BRUCE GORDON	VALHALLA ROAD V3J4S7	Yes.	
FRANK SIA TONY SIA (Family Trust)	JASON PLACE RD. & SUB. DIV.	Yes	By fax Frank Sia 992-3202
DALE JOYAL	RICHARDS ROAD	Yes.	Dale Joyal

Copy.

E.F Ambery,
352 Richards Road, Box 11
Quesnel, B.C. V2J 3S3
1 March 2003
747-4399

All Water User
Richards Road
Quesnel, B.C.

The present water suppler will not be able to supply water on a permanent basis and suggests that there may be three other alternate sources of water.

1. You can drill a well on your own or in conjunction with three other properties and thus enjoy an independent source.

2. Form a 'Water Users District' in conjunction with all other local properties and thus enjoy a locally controlled source.

3. Petition the City of Quesnel to extend their water mains to include your property for water service.

When the City expanded the boundaries a few years ago and this area was designated by by-law as an area which would be taxed to finance the extension of the water mains then you should look to them for this service.

Further to my previous letters on this matter of water supply this letter is to advise that I am no longer financially or physically able to go on with this work.

Each and every resident here on Richards Road should forthwith petition the City of Quesnel to provide a water service to the area.

Betty Ambery.

APPENDIX B

Investigation Calculations

CITY OF QUESNEL
SOUTH QUESNEL WATER SYSTEM
PHASE 1
COST ESTIMATE - FEASIBILITY STUDY

Item	Description	Unit	Estimated Quantity		Unit Price		Total
A. DVC DEVELOPMENTS LTD. SYSTEM							
1	Mobilization, Demobilization and Survey Layout	LS	1	$	10,000	$	10,000
2	Decommissioning and Demolition of Existing Well, Booster Station and Site Piping	LS	1	$	15,000	$	15,000
3	Survey Layout	LS	1	$	4,000	$	4,000
4	Asphalt Removal	LS	1	$	5,000	$	5,000
5	Excavate, Locate and Expose Existing Utilities	LS	1	$	4,000	$	4,000
6	250 mm PVC Water Main c/w Native Backfill	m	390	$	170	$	66,300
7	200 mm PVC Water Main c/w Native Backfill	m	120	$	155	$	18,600
8	150 mm PVC Water Main c/w Native Backfill (Toby Rd. and May Rd.)	m	455	$	130	$	59,150
9	Allowance for Gas Main Crossing	LS	1	$	5,000	$	5,000
10	Tracer Wire	m	965	$	3	$	2,895
11	Tracer Wire Monitoring Stations	ea	8	$	700	$	5,600
12	Fittings and Valves	LS	1	$	10,000	$	10,000
13	End Cap and Blowoff Assembly	ea	5	$	700	$	3,500
14	Hydrant Assembly c/w Mainline Tee / Gate Valve Assembly (New Main)	ea	5	$	5,900	$	29,500
15	Hydrant Assembly c/w Mainline Tee / Gate Valve Assembly (Retrofit)	ea	3	$	7,000	$	21,000
16	Service Connections to Property Line (25 mm Dia. Assumed)	ea	32	$	1,700	$	54,400
17	Flushing, Chlorination and Testing	LS	1	$	9,000	$	9,000
18	Tie-In to Existing System	ea	6	$	1,500	$	9,000
19	Culvert Replacements	LS	1	$	5,000	$	5,000
20	Allowance for Road and Driveway Reconstruction	LS	1	$	100,000	$	100,000
21	Ditching and Boulevard Restoration	LS	1	$	15,000	$	15,000
	Sub-Total (Rounded)					$	452,000
B. RICHARDS ROAD AREA							
1	Mobilization and Demobilization	LS	1	$	15,000	$	15,000
2	Decommissioning of Existing Well and Site Piping	LS	1	$	4,000	$	4,000
3	Survey Layout	LS	1	$	4,000	$	4,000
4	Asphalt Removal	LS	1	$	5,000	$	5,000
5	Excavate, Locate and Expose Existing Utilities	LS	1	$	4,000	$	4,000
6	150 mm PVC Watermain c/w Native Backfill	m	250	$	130	$	32,500
7	250 mm PVC Watermain c/w Native Backfill	m	1230	$	170	$	209,100
8	Allowance for Gas Main Crossing	LS	1	$	5,000	$	5,000
9	Tracer Wire	m	1480	$	3	$	4,440
10	Tracer Wire Monitoring Stations	ea	8	$	700	$	5,600
11	Fittings and Valves	LS	1	$	27,000	$	27,000
12	End Cap and Blowoff Assembly	ea	3	$	700	$	2,100
13	Fire Hydrant Assembly	ea	10	$	5,900	$	59,000
14	Service Connections to Property Line (25 mm Dia. Assumed)	ea	32	$	1,700	$	54,400
15	Flushing, Chlorination and Testing	LS	1	$	6,000	$	6,000
16	Tie-In to Existing System	ea	1	$	4,000	$	4,000
17	Culvert Replacements	LS	1	$	5,000	$	5,000
18	Pavement Repair and Gravel Road Restoration	LS	1	$	70,000	$	70,000
19	Ditching and Boulevard Restoration	LS	1	$	20,000	$	20,000
	Sub-Total (Rounded)					$	536,000
	Sub-Total (Items A and B)					$	988,000
	Engineering and Contingency (35%)					$	345,800
	Allowance for Administration and Financing					$	50,000
	Estimated On-Site Inspection (Assume 8 Week Construction Period)					$	30,000
	Sub-Total (Rounded)					$	1,414,000
	7% GST					$	99,000
	TOTAL					**$**	**1,513,000**

CITY OF QUESNEL
SOUTH QUESNEL WATER SYSTEM
PHASE 2
COST ESTIMATE - FEASIBILITY STUDY

Item	Description	Unit	Estimated Quantity		Unit Price		Total
1	Mobilization, Demobilization	LS	1	$	10,000	$	10,000
2	Survey Layout	LS	1	$	4,000	$	4,000
3	Asphalt Removal	LS	1	$	5,000	$	5,000
4	Excavate, Locate and Expose Existing Utilities	LS	1	$	4,000	$	4,000
5	150 mm PVC Water Main c/w Native Backfill	m	335	$	130	$	43,550
6	200 mm PVC Water Main c/w Native Backfill	m	390	$	155	$	60,450
7	250 mm PVC Water Main c/w Native Backfill	m	535	$	170	$	90,950
8	Tracer Wire	m	1260	$	3	$	3,780
9	Tracer Wire Monitoring Stations	ea	6	$	700	$	4,200
10	Fittings and Valves	LS	1	$	12,000	$	12,000
11	End Cap and Blowoff Assembly	ea	2	$	700	$	1,400
12	Main)	ea	6	$	5,900	$	35,400
13	Service Connections to Property Line (25 mm Dia. Assumed)	ea	35	$	1,700	$	59,500
14	Flushing, Chlorination and Testing	LS	1	$	7,000	$	7,000
15	Tie-In to Existing System	ea	2	$	1,500	$	3,000
16	Culvert Replacements	LS	1	$	10,000	$	10,000
17	Allowance for Road and Driveway Reconstruction	LS	1	$	70,000	$	70,000
18	Ditching and Boulevard Restoration	LS	1	$	20,000	$	20,000
	Sub-Total (Rounded)					$	444,000
	Engineering and Contingency (35%)					$	155,400
	Allowance for Administration and Financing					$	20,000
	Estimated On-Site Inspection (assume 4 week construction period)					$	20,000
	Sub-Total (Rounded)					$	639,000
	7% GST					$	45,000
	TOTAL					**$**	**684,000**

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

title: **SOUTH HILLS WATER EXTENSION – WESTLAND CLOSE**
date: February 23, 2009
file no.: 1190.0131.02

A possible concept for extending municipal water service into Westland Close is shown on the back of this form. The proposed system would service 20 properties.

A preliminary cost estimate has been developed that relates to servicing the area. That cost includes a contribution to major system works (i.e. the reservoir, major trunk mains, supply well and booster station), as well as construction of a local distribution system to meet municipal standards.

Area	Local Distribution System	Cost Per Parcel		Total (i.e. Commuted) Value	Annual Parcel Tax (20 Years)
		Local Distribution System	Major Works Contribution		
	(a)	*(b) = (a) / # lots*	*(c)*	*(b) + (c)*	
Westland Place	$720,000	$36,000	$???	$???	$???

In addition to this cost, each homeowner would be expected to pay for that portion of work on their property, as required to connect to the municipal water system.

Council has requested staff to solicit input from the property owners to determine if sufficient interest exists to merit further development of this concept.

Please identify the location of your property by placing an X in the appropriate location on the map and indicate whether you are in favour of the proposed improvement or opposed.

I am:

In favour of the proposed improvement _____

Not in favour of the proposed improvement _____

Comments: _____

_____

Print name: _____

Signature: _____

Property: _____

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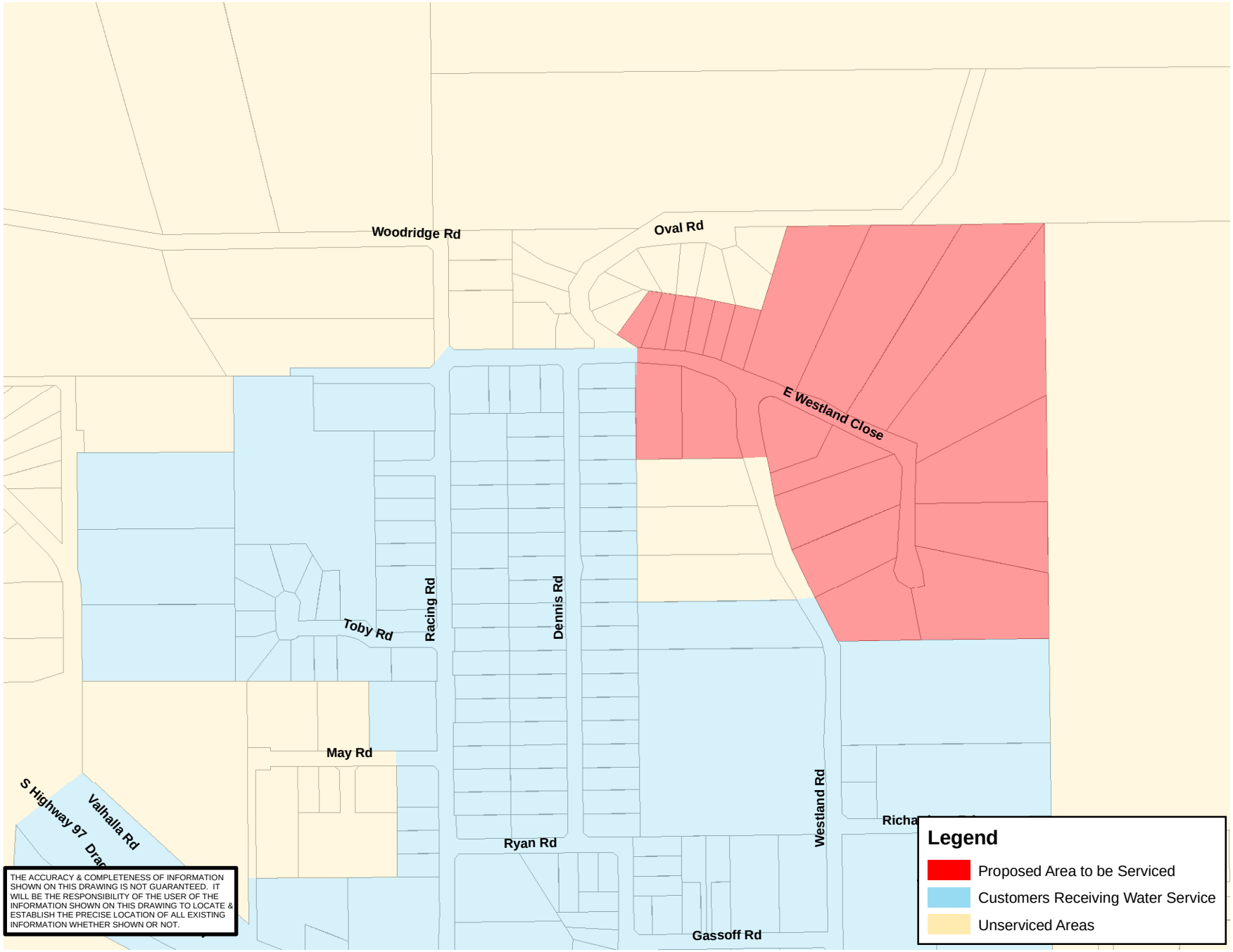
URBANSYSTEMS.

WESTLAND ROAD & WATERMAIN UPGRADE

DATE: FEBRUARY 2009

CITY OF QUESNEL

1:7,000



THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT.

File Path: U:\Projects_KAM\1197001\3102\D-Drafting\Design Analysis\GIS\Projects\FIG 3 - Service_Area.mxd

SERVICE AREA OVERVIEW

URBANSYSTEMS.

Date: March 3, 2009
Job No: 1190.0131.02

City of Quesnel
Table 1
Westland Close Watermain Extension - Including 250 mm Diameter Portion

Item	Description	Unit	Estimated Quantity	Unit Price	Total
1.0	**General**				
	Mobilization/Demobilization	LS	1	$ 10,000	$ 10,000
				Subtotal General	$ 10,000
2.0	**Roadworks**				
	Asphalt removal (saw cut and disposal)	m^2	2,200	$ 15	$ 33,000
	Asphalt replacement (watermain trench and services)	m^2	2,200	$ 30	$ 66,000
				Subtotal Roadworks	$ 99,000
3.0	**Waterworks**				
	Watermain C900 PVC CL150				
	200 mm ø	m	620	$ 275	$ 170,500
	Fittings & valves				
	200 mm gate valve	ea	6	$ 1,700	$ 10,200
	200 mm tee	ea	2	$ 1,700	$ 3,400
	200 mm end cap	ea	3	$ 1,000	$ 3,000
	200 mm bends	ea	5	$ 1,200	$ 6,000
	Fire hydrants (including mainline tee, gate valve, lead, drain rock, hydrant access path)	ea	5	$ 6,000	$ 30,000
	Service connection (20mm including restoration to ditch)	ea	20	$ 4,000	$ 80,000
	Connection to existing main	LS	1	$ 10,000	$ 10,000
				Subtotal Waterworks	$ 313,100
	SUB-TOTAL				**$ 422,100**
	Survey and Geotech				$ 30,000
	Contingency (25%)				$ 114,000
	Engineering (12%)				$ 68,000
	TOTAL				**$ 634,100**

Cost Per Lot (20 lots) $ 31,705

URBANSYSTEMS.

Date: March 3, 2009
Job No: 1190.0131.02

City of Quesnel
Table 2
Westland Close Watermain Extension - Excluding 250 mm Diameter Portion

Item	Description	Unit	Estimated Quantity	Unit Price	Total
1.0 General					
	Mobilization/Demobilization	LS	1	$ 10,000	$ 10,000
				Subtotal General	$ 10,000
2.0 Roadworks					
	Asphalt removal (saw cut and disposal)	m^2	1,600	$ 15	$ 24,000
	Asphalt replacement (watermain trench and services)	m^2	1,600	$ 30	$ 48,000
				Subtotal Roadworks	$ 72,000
3.0 Waterworks					
	Watermain C900 PVC CL150				
	200 mm ø	m	380	$ 275	$ 104,500
	Fittings & valves				
	200 mm gate valve	ea	6	$ 1,700	$ 10,200
	200 mm tee	ea	2	$ 1,700	$ 3,400
	200 mm end cap	ea	3	$ 1,000	$ 3,000
	200 mm bends	ea	5	$ 1,200	$ 6,000
	Fire hydrants (including mainline tee, gate valve, lead, drain rock, hydrant access path)	ea	3	$ 6,000	$ 18,000
	Service connection (20mm including restoration to ditch)	ea	20	$ 4,000	$ 80,000
	Connection to existing main	LS	1	$ 10,000	$ 10,000
				Subtotal Waterworks	$ 235,100
	SUB-TOTAL				**$ 317,100**
	Survey and Geotech				$ 30,000
	Contingency (25%)				$ 87,000
	Engineering, Tendering and Construction Administration (12%)				$ 53,000
	TOTAL				**$ 487,100**

Cost Per Lot (20 lots)	$ 24,355
Major Infrastructure Contribution	$ 4,414
Total Cost Per Lot	**$ 28,769**

URBANSYSTEMS.

Date: March 3, 2009
Job No: 1190.0131.02

City of Quesnel
Table 3
Westland Close Watermain Extension - Excluding 250 mm Diameter Portion and Include Services on Westland Road

Item	Description	Unit	Estimated Quantity	Unit Price	Total
1.0	**General**				
	Mobilization/Demobilization	LS	1	$ 10,000	$ 10,000
				Subtotal General	$ 10,000
2.0	**Roadworks**				
	Asphalt removal (saw cut and disposal)	m^2	1,600	$ 15	$ 24,000
	Asphalt replacement (watermain trench and services)	m^2	1,600	$ 30	$ 48,000
				Subtotal Roadworks	$ 72,000
3.0	**Waterworks**				
	Watermain C900 PVC CL150				
	200 mm ø	m	380	$ 275	$ 104,500
	Fittings & valves				
	200 mm gate valve	ea	6	$ 1,700	$ 10,200
	250 mm tee	ea	2	$ 1,500	$ 3,000
	200 mm end cap	ea	3	$ 1,000	$ 3,000
	200 mm bends	ea	5	$ 1,200	$ 6,000
	Fire hydrants (including mainline tee, gate valve, lead, drain rock, hydrant access path)	ea	3	$ 6,000	$ 18,000
	Service connection (20mm including restoration to ditch)	ea	23	$ 4,000	$ 92,000
	Connection to existing main	LS	1	$ 10,000	$ 10,000
				Subtotal Waterworks	$ 246,700
	SUB-TOTAL				**$ 328,700**
	Survey and Geotech				$ 30,000
	Contingency (25%)				$ 90,000
	Engineering, Tendering and Construction Administration (12%)				$ 54,000
	TOTAL				**$ 502,700**

Cost Per Lot (23 lots)	$ 21,857
Major Infrastructure Contribution	$ 4,414
Total Cost Per Lot	**$ 26,271**

APPENDIX B

2012 Servicing Concepts and Cost Estimates

AREA A - THREE MILE FLAT - SEWER								
	Item	**Unit**	**Quantity**	**Unit Price- 2000**	**Total-2000**	**Unit Price - 2012**	**Updated Units 2012**	**Total- 2012**
1.0	**200 dia. Sanitary Main**							
	0 - 2.5 m depth	m	910	$ 90	$ 81,900	$ 150	1075	$ 161,250
	2.5 - 3.5 m depth	m	1055	$ 105	$ 110,775	$ 175	1220	$ 213,500
	3.5 - 4.5 m depth	m	205	$ 125	$ 25,625	$ 200	370	$ 74,000
	4.5 - 5.5 m depth	m	70	$ 180	$ 12,600	$ 230		$ 16,100
	5.5 - 6.5 m depth	m	65	$ 240	$ 15,600	$ 265		$ 17,225
	6.5 - 7.5 m depth	m	750	$ 295	$ 221,250	$ 305		$ 228,750
2.0	**Services**							$ -
	100 dia.	ea	68	$ 1,000	$ 68,000	$ 2,000	70	$ 140,000
3.0	**Horizontal Drilling**							$ -
	400 mm dia.	m	35	$ 1,500	$ 52,500	$ 1,500		$ 52,500
4.0	**Manholes**							$ -
	Bases, Frames, Covers	ea	26	$ 1,400	$ 36,400	$ 2,000	30	$ 60,000
	1050 Ø Barrels	vm	100	$ 375	$ 37,500	$ 1,000	110	$ 110,000
5.0	**Restoration**							$ -
	Asphalt Surface	m^2	1500	$ 27	$ 40,500	$ 40	3625	$ 145,000
	Gravel Surface	m^2	4000	$ 12	$ 48,000	$ 15	1875	$ 28,125
	Other	m^2	18000	$ 3	$ 54,000	$ 5		$ 90,000
				Contigency (30%)	**$ 241,395**			**$ 400,935**
				TOTAL	**$ 1,046,045**			**$ 1,737,385**

AREA A - TWO MILE FLAT - SEWER							
	Item	**Unit**	**Quantity**	**Unit Price- 2000**	**Total-2000**	**Unit Price - 2012**	**Total -2012**
1.0	**200 dia. Sanitary Main**						
	0 - 2.5 m depth	m	450	$ 90	$ 40,500	$ 150	$ 67,500
	2.5 - 3.5 m depth	m	3515	$ 105	$ 369,075	$ 175	$ 615,125
	3.5 - 4.5 m depth	m	825	$ 125	$ 103,125	$ 200	$ 165,000
	4.5 - 5.5 m depth	m	80	$ 180	$ 14,400	$ 230	$ 18,400
2.0	**300 dia. Sanitary Main**						$ -
	0 - 2.5 m depth	m	30	$ 115	$ 3,450	$ 180	$ 5,400
	2.5 - 3.5 m depth	m	220	$ 130	$ 28,600	$ 200	$ 44,000
	3.5 - 4.5 m depth	m	770	$ 150	$ 115,500	$ 220	$ 169,400
	4.5 - 5.5 m depth	m	120	$ 205	$ 24,600	$ 250	$ 30,000
3.0	**Services**						$ -
	100 dia.	ea	75	$ 1,000	$ 75,000	$ 2,000	$ 150,000
	150 dia.	ea	7	$ 1,100	$ 7,700	$ 2,500	$ 17,500
4.0	**Horizontal Drilling**						$ -
	400 mm dia.	m	280	$ 1,500	$ 420,000	$ 1,500	$ 420,000
5.0	**Manholes**						$ -
	Bases, Frames, Covers	ea	52	$ 1,400	$ 72,800	$ 2,000	$ 104,000
	1050 Ø Barrels	vm	160	$ 375	$ 60,000	$ 1,000	$ 160,000
6.0	**Restoration**						$ -
	Asphalt Surface	m^2	17500	$ 27	$ 472,500	$ 40	$ 700,000
	Gravel Surface	m^2	5300	$ 12	$ 63,600	$ 15	$ 79,500
	Other	m^2	11500	$ 3	$ 34,500	$ 5	$ 57,500
7.0	**Lift Station**	ea	1	$ 60,000	$ 60,000	$ 90,000	$ 90,000
				Contigency (30%)	$ 589,605		$ 867,998
				TOTAL	**$ 2,554,955**		**$ 3,761,323**

AREA A - CONNECTION TO SYSTEM (FOR 2 & 3 MILE FLAT) - SEWER

	Item	Unit	Quantity	Unit Price- 2000	Total-2000	Unit Price - 2012	Total -2012
1.0	**Pressure Main**						
	Pressure Main	m	1100	$ 110	$ 121,000	$ 150	$ 165,000
2.0	**Connection to Existing Forcemain**						$ -
	Coneection	ea	1	$ 10,000	$ 10,000	$ 10,000	$ 10,000
3.0	**Horizontal Drilling**						$ -
	400 mm dia.	ea	70	$ 1,500	$ 105,000	$ 1,500	$ 105,000
4.0	**Restoration**						$ -
	Asphalt Surface	m^2	1500	$ 27	$ 40,500	$ 40	$ 60,000
	Gravel	m^2	500	$ 12	$ 6,000	$ 15	$ 7,500
	Other	m^2	3000	$ 3	$ 9,000	$ 5	$ 15,000
7.0	**Lift Station**	ea	1	$ 240,000	$ 240,000	$ 300,000	$ 300,000
				Contigency (30%)	$ 159,450		$ 198,750
				TOTAL	**$ 690,950**		**$ 861,250**

AREA B - WALKHEM STREET NORTH

	Item	Unit	Quantity	Unit Price- 2000	Total	Unit Price - 2012	Total
1.0	**Pressure Main**						
	Pressure Main	m	400	$ 75	$ 30,000	$ 120	$ 48,000
2.0	**Septic Tank and Pump Chambers**						
	Septic Tank and Chambers	ea	9	$ 5,000	$ 45,000	$ 6,500	$ 58,500
3.0	**Odour Removal**						
	Odour Control Unit	ea	1	$ 4,000	$ 4,000	$ 10,000	$ 10,000
4.0	**Restoration**						$ -
	Asphalt Surface	m^2	500	$ 27	$ 13,500	$ 40	$ 20,000
	Landscaped	m^2	800	$ 7	$ 5,600	$ 10	$ 8,000
	Other	m^2	1200	$ 3	$ 3,600	$ 5	$ 6,000
				Contigency (30%)	$ 30,510		$ 45,150
				TOTAL	**$ 132,210**		**$ 195,650**

AREA C - WESTLAND CLOSE - WATER

Item	Description	Unit	Estimated Quantity	Unit Price - 2009	Total 2009	Updated Quantities 2012	Unit Prices - 2012	Total -2012
1.0 General								
	Mobilization/Demobilization	LS	1	$ 10,000	$ 10,000	1	$ 10,000	$ 10,000
				Subtotal General	$ 10,000			$ -
2.0 Roadworks								$ -
	Asphalt removal (saw cut and disposal)	m^2	2,200	$ 15	$ 33,000	0		$ -
	Asphalt replacement (watermain trench and services)	m^2	2,200	$ 30	$ 66,000	2700	$ 40	$ 108,000
				Subtotal Roadworks	$ 99,000			$ -
3.0 Waterworks								$ -
	Watermain C900 PVC CL150							$ -
	150 mm ø	m	620	$ 275	$ 170,500	300	$ 250	$ 75,000
	200 mm ø					400	$ 275	$ 110,000
	250 mm ø					600	$ 300	$ 180,000
	Fittings & valves							$ -
	Gate valve	ea	6	$ 1,700	$ 10,200	8	$ 1,700	$ 13,600
	Tee	ea	2	$ 1,700	$ 3,400	3	$ 1,700	$ 5,100
	End cap	ea	3	$ 1,000	$ 3,000	3	$ 1,000	$ 3,000
	Bends	ea	5	$ 1,200	$ 6,000	9	$ 1,200	$ 10,800
	Fire hydrants (including mainline tee, gate valve, lead, drain rock, hydrant access path)	ea	5	$ 6,000	$ 30,000	7	$ 6,000	$ - $ 42,000
	Service connection (20mm including restoration to ditch)	ea	20	$ 4,000	$ 80,000	38	$ 4,000	$ 152,000
	Connection to existing main	LS	1	$ 10,000	$ 10,000	2	$ 10,000	$ 20,000
				Subtotal Waterworks	$ 313,100			
				SUB-TOTAL	**$ 422,100**			**$ 729,500**
				Survey and Geotech	$ 30,000			$ 30,000
				Contingency (25%)	$ 114,000			$ 189,875
				Engineering (12%)	$ 68,000			$ 113,925
				TOTAL	**$ 634,000**			**$ 1,063,300**

AREA D & G - RICHARDS ROAD / WOODRIDGE ROAD - WATER								
Item	Description	Unit	Estimated Quantity	Unit price 2005	Total - 2005	Updated Quantities 2012	Updated 2012 Unit Costs	TOTAL
1	Mobilization and Demobilization	LS	1	$ 18,000	$ 18,000		$ 20,000	$ 20,000
2	Decommissioning of Existing Well and Site Piping	LS	1	$ 4,000	$ 4,000		$ 5,000	$ 5,000
3	Survey Layout	LS	1	$ 5,000	$ 5,000		$ 7,000	$ 7,000
4	Asphalt Removal	LS	1	$ 7,000	$ 7,000		$ -	$ -
5	Excavate, Locate and Expose Existing Utilities	LS	1	$ 5,000	$ 5,000		$ 5,000	$ 5,000
~~6~~	150 mm PVC Water Main c/w Native Backfill (May Rd.)	m	220	$ 150	$ 33,000	~~0~~	$ 250	$ -
7	150 mm PVC Watermain c/w Native Backfill	m	75	$ 150	$ 11,250	110	$ 250	$ 27,500
8	200 mm PVC Watermain c/w Native Backfill - May be Upsized to Accommodate Future 250 mm Loop	m	1230	$ 170	$ 209,100	1920	$ 275	$ 528,000
9	Allowance for Gas Main Crossing	LS	1	$ 10,000	$ 10,000		$ 15,000	$ 15,000
10	Tracer Wire	m	1305	$ 3	$ 3,915	2030	$ 5	$ 10,150
11	Tracer Wire Monitoring Stations	ea	8	$ 900	$ 7,200	10	$ 400	$ 4,000
12	Fittings and Valves	LS	1	$ 30,000	$ 30,000		$ 70,000	$ 70,000
13	End Cap and Blowoff Assembly	ea	3	$ 1,000	$ 3,000		$ 1,000	$ 3,000
14	Fire Hydrant Assembly	ea	11	$ 5,900	$ 64,900	16	$ 6,000	$ 96,000
15	Service Connections to Property Line (25 mm Dia. Assumed)	ea	34	$ 2,500	$ 85,000	46	$ 3,500	$ 161,000
16	Flushing, Chlorination and Testing	LS	1	$ 7,000	$ 7,000	1	$ 10,000	$ 10,000
17	Tie-In to Existing System	ea	2	$ 5,000	$ 10,000		$ 10,000	$ 20,000
18	Culvert Replacements	LS	1	$ 7,000	$ 7,000		$ 10,000	$ 10,000
19	Pavement Repair and Gravel Road Restoration	LS	1	$ 125,000	$ 125,000		$ 155,000	$ 155,000
20	Ditching and Boulevard Restoration	LS	1	$ 25,000	$ 25,000		$ 30,000	$ 30,000
								$ -
	Sub-Total (Rounded)				$ 670,000			$ 1,176,650
	Contingency (25% of Sub-total)				$ 168,000			$ 294,163
	Construction Sub-Total				$ 838,000			$ 1,470,813
	Engineering and Onsite Inspection (15% Construction Sub-total)				$ 126,000			$ 220,622
	Total - Richards Rd. and May Rd. Area				**$ 964,000**			**$ 1,691,434**

Area D & G - RICHARDS ROAD/WOODRIDGE ROAD - SEWER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total - 2012**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	900	$ 150	$ 135,000
	2.5 - 3.5 m depth	m	125	$ 175	$ 21,875
	3.5 - 4.5 m depth	m	475	$ 200	$ 95,000
	6.5 - 7.5 m depth	m	200	$ 305	$ 61,000
3.0	**Services**				
	100 dia.	ea	38	$ 2,000	$ 76,000
4.0	**Manholes**				
	Bases, Frames, Covers	ea	18	$ 2,000	$ 36,000
	1050 Ø Barrels	vm	35	$ 1,000	$ 35,000
5.0	**Restoration**				
	Asphalt Surface	m2	4500	$ 40	$ 180,000
				Contigency (30%)	$ 191,963
				TOTAL	**$ 831,838**

RACING ROAD/WOODRIDGE - UP TO GAS LINE								
Item	Description	Unit	Estimated Quantity	Unit price 2005	Total - 2005	Updated Quantities 2012	Updated 2012 Unit Costs	TOTAL
1	Mobilization and Demobilization	LS	1	$ 18,000	$ 18,000	1	$ 10,000	$ 10,000
2	Decommissioning of Existing Well and Site Piping	LS	1	$ 4,000	$ 4,000	0	$ 5,000	$ -
3	Survey Layout	LS	1	$ 5,000	$ 5,000	1	$ 7,000	$ 7,000
4	Asphalt Removal	LS	1	$ 7,000	$ 7,000		$ -	$ -
5	Excavate, Locate and Expose Existing Utilities	LS	1	$ 5,000	$ 5,000	1	$ 5,000	$ 5,000
~~6~~	150 mm PVC Water Main c/w Native Backfill (May Rd.)	m	220	$ 150	$ 33,000	~~0~~	$ 250	$ -
7	150 mm PVC Watermain c/w Native Backfill	m	75	$ 150	$ 11,250	0	$ 250	$ -
8	200 mm PVC Watermain c/w Native Backfill - May be Upsized to Accommodate Future 250 mm Loop	m	1230	$ 170	$ 209,100	550	$ 275	$ 151,250
9	Allowance for Gas Main Crossing	LS	1	$ 10,000	$ 10,000	0	$ 15,000	$ -
10	Tracer Wire	m	1305	$ 3	$ 3,915	550	$ 5	$ 2,750
11	Tracer Wire Monitoring Stations	ea	8	$ 900	$ 7,200	3	$ 400	$ 1,200
12	Fittings and Valves	LS	1	$ 30,000	$ 30,000	1	$ 35,000	$ 17,500
13	End Cap and Blowoff Assembly	ea	3	$ 1,000	$ 3,000	1	$ 1,000	$ 1,000
14	Fire Hydrant Assembly	ea	11	$ 5,900	$ 64,900	4	$ 6,000	$ 24,000
15	Service Connections to Property Line (25 mm Dia. Assumed)	ea	34	$ 2,500	$ 85,000	12	$ 3,500	$ 42,000
16	Flushing, Chlorination and Testing	LS	1	$ 7,000	$ 7,000	1	$ 5,000	$ 5,000
17	Tie-In to Existing System	ea	2	$ 5,000	$ 10,000	1	$ 10,000	$ 10,000
18	Culvert Replacements	LS	1	$ 7,000	$ 7,000	0	$ 10,000	$ -
19	Pavement Repair and Gravel Road Restoration	LS	1	$ 125,000	$ 125,000	1	$ 15,000	$ 15,000
20	Ditching and Boulevard Restoration	LS	1	$ 25,000	$ 25,000	1	$ 15,000	$ 15,000
								$ -
	Sub-Total (Rounded)				$ 670,000			$ 306,700
	Contingency (25% of Sub-total)				$ 168,000			$ 76,675
	Construction Sub-Total				$ 838,000			$ 383,375
	Engineering and Onsite Inspection (15% Construction Sub-total)				$ 126,000			$ 57,506
	Total - RACING ROAD				**$ 964,000**			**$ 440,881**

AREA C & E - DVC AND WESTLAND CLOSE - SEWER

Item	Description	Unit	Estimated Quantity	Unit Price - 2003	Total - 2003	Unit Price - 2012	Updated Quantities -2012	TOTAL - 2012
	SUB-AREA 1							
1	Clearing and Grubbing (0.4 ha.)	LS	1		$ 2,400	$ 6,000		$ 6,000
2	200mm PVC Gravity Sewer Main incl. Sand Bedding							
	0 - 2.5 m depth	m	383	$ 90	$ 34,470	$ 150		$ 57,450
	2.5 - 3.5 m depth	m	525	$ 130	$ 68,250	$ 175		$ 91,875
	> 3.5 m depth	m	30	$ 150	$ 4,500	$ 200		$ 6,000
3	Pipeline Crossing	m	40	$ 300	$ 12,000	$ 500		$ 20,000
4	1050mm Manholes							$ -
	Barrel	v.m.	28	$ 500	$ 14,000	$ 1,000		$ 28,000
	Base, Lid, Frame and Cover	each	12	$ 2,200	$ 26,400	$ 2,000		$ 24,000
5	Tie into Existing Manhole	each	1	$ 1,500	$ 1,500	$ 1,500		$ 1,500
6	PVC Gravity Sewer Service (on City property/ right-of-way)	m	250	$ 60	$ 15,000	$ 125		$ 31,250
7	Sanitary Service Connection to Main	each	15	$ 250	$ 3,750	$ 350		$ 5,250
8	Sanitary Service Connection to Manhole	each	14	$ 350	$ 4,900	$ 500		$ 7,000
9	PVC Gravity Sewer Service Inspection Chamber	each	29	$ 300	$ 8,700	$ 500		$ 14,500
10	Asphalt Sawcut	m	860	$ 5	$ 4,300	$ 7		$ 6,020
11	Road and Paved Driveway Restoration	m²	1,160	$ 30	$ 34,800	$ 40		$ 46,400
12	Road Shoulder and Gravel Driveway Restoration	m²	1,710	$ 8	$ 13,680	$ 12		$ 20,520
13	Boulevard Restoration	m²	1,640	$ 3	$ 4,920	$ 5		$ 8,200
	SUB-TOTAL (Rounded)				**$ 254,000**			**$ 373,965**
	Engineering and Contingency , 25% (Rounded)				$ 64,000			**$ 93,491**
	Allowance for Legal Surveys and Easement Registration				$ 8,000			$ 10,000
	SUB-TOTAL				**$ 326,000**			**$ 477,456**
	SUB-AREA 2							
1	Clearing, Grubbing and Stripping (0.1 ha.)	LS	1		$ 400	$ 1,500		$ 1,500
2	200mm PVC Gravity Sewer Main incl. Sand Bedding							$ -
	0 - 2.5 m depth	m	325	$ 90	$ 29,250	$ 150		$ 48,750
	2.5 - 3.5 m depth	m	110	$ 130	$ 14,300	$ 175		$ 19,250
	> 3.5 m depth	m	225	$ 150	$ 33,750	$ 200		$ 45,000
3	1050mm Manholes							$ -
	Barrel	v.m.	19	$ 500	$ 9,500	$ 1,000		$ 19,000
	Base, Lid, Frame and Cover	each	7	$ 2,200	$ 15,400	$ 2,000		$ 14,000
4	Tie into Existing Manhole	each	2	$ 1,500	$ 3,000	$ 1,500		$ 3,000
5	PVC Gravity Sewer Service (on City property/ right-of-way)	m	270	$ 60	$ 16,200	$ 125		$ 33,750
6	Sanitary Service Connection to Main	each	20	$ 250	$ 5,000	$ 350		$ 7,000
7	Sanitary Service Connection to Manhole	each	13	$ 350	$ 4,550	$ 500		$ 6,500
8	PVC Gravity Sewer Service Inspection Chamber	each	33	$ 300	$ 9,900	$ 500		$ 16,500
9	Asphalt Sawcut	m	750	$ 5	$ 3,750	$ 7		$ 5,250
10	Road and Paved Driveway Restoration	m²	1,150	$ 30	$ 34,500	$ 30		$ 34,500
11	Road Shoulder and Gravel Driveway Restoration	m²	1,620	$ 8	$ 12,960	$ 15		$ 24,300
12	Boulevard Restoration	m²	1,330	$ 3	$ 3,990	$ 5		$ 6,650
	SUB-TOTAL (Rounded)				**$ 196,000**			**$ 284,950**
	Engineering and Contingency , 25% (Rounded)				$ 49,000			$ 71,238
	Allowance for Legal Surveys and Easement Registration				$ 5,000			$ 8,000
	SUB-TOTAL				**$ 250,000**			**$ 364,188**
	SUB-AREA 3							
1	Clearing and Grubbing (0.1 ha.)	LS	1		$ 500	$ 1,500		$ 1,500
2.1	200mm PVC Gravity Sewer Main incl. Sand Bedding, < 3m	m	250	$ 90	$ 22,500	$ 150		$ 37,500
2.2	200mm PVC Gravity Sewer Main incl. Sand Bedding, > 3m	m	140	$ 150	$ 21,000	$ 200		$ 28,000
3	1050mm Manholes	each	5	$ 4,500	$ 22,500	$ 7,000		$ 35,000
4	100mm PVC Gravity Sewer Service	m	270	$ 60	$ 16,200	$ 125		$ 33,750
5	100mm PVC Gravity Sewer Service Inspection Chamber	each	13	$ 200	$ 2,600	$ 450		$ 5,850
6	25mm PE Series 100 Pressure Sewer Service - 2.5m deep	m	180	$ 40	$ 7,200	$ 80		$ 14,400
7	25mm Residential Pump Station Package	each	5	$ 4,000	$ 20,000	$ 5,200		$ 26,000
8	Residential Pump Station Electrical Connection	each	5	$ 500	$ 2,500	$ 650		$ 3,250
9	Yard Restoration	each	13	$ 500	$ 6,500	$ 650		$ 8,450
10	Road Restoration	m²	1,200	$ 30	$ 36,000	$ 40		$ 48,000
	SUB-TOTAL				**$ 157,500**			**$ 241,700**
	Engineering and Contingency , 35% (Rounded)				$ 55,000			$ 84,595
	SUB-TOTAL				**$ 212,500**			**$ 326,295**
	SUB-AREA 4							
1	Clearing, Grubbing and Stripping (0.1 ha.)	LS	1		$ 800	$ 1,500		$ 1,500
2	200mm PVC Gravity Sewer Main incl. Sand Bedding							$ -
	0 - 2.5 m depth	m	220	$ 90	$ 19,800	$ 150		$ 33,000
	2.5 - 3.5 m depth	m	145	$ 130	$ 18,850	$ 175		$ 25,375
3	Pipeline Crossing	m	40	$ 300	$ 12,000	$ 500		$ 20,000
4	1050mm Manholes							$ -
	Barrel	v.m.	10	$ 500	$ 5,000	$ 1,000		$ 10,000
	Base, Lid, Frame and Cover	each	5	$ 2,200	$ 11,000	$ 2,000		$ 10,000
5	Tie into Existing Manhole	each	1	$ 1,500	$ 1,500	$ 1,500		$ 1,500
6	PVC Gravity Sewer Service (on City property/right-of-way)	m	90	$ 60	$ 5,400	$ 150		$ 13,500
7	Sanitary Service Connection to Main	each	6	$ 250	$ 1,500	$ 350		$ 2,100
8	Sanitary Service Connection to Manhole	each	5	$ 350	$ 1,750	$ 500		$ 2,500
9	PVC Gravity Sewer Service Inspection Chamber	each	11	$ 300	$ 3,300	$ 500		$ 5,500
10	Asphalt Sawcut	m	280	$ 5	$ 1,400	$ 7		$ 1,960
11	Road and Paved Driveway Restoration	m²	600	$ 30	$ 18,000	$ 40		$ 24,000
12	Road Shoulder Restoration	m²	120	$ 8	$ 960	$ 15		$ 1,800
13	Boulevard and Yard Restoration (along sewer main length)	m²	690	$ 3	$ 2,070	$ 5		$ 3,450
	SUB-TOTAL (Rounded)				**$ 103,000**			**$ 156,185**
	Engineering and Contingency , 25% (Rounded)				$ 26,000			$ 39,046
	Allowance for Legal Surveys and Easement Registration				$ 6,000			$ 10,000
	SUB-TOTAL				**$ 135,000**			**$ 205,231**
	SUB-AREA 5 - Westland Close							
1	Clearing and Grubbing (0.2 ha.)	LS	1		$ 1,600	$ 3,000		$ 3,000
2.1	200mm PVC Gravity Sewer Main incl. Sand Bedding, < 3m	m	380	$ 90	$ 34,200	$ 150		$ 57,000
2.2	200mm PVC Gravity Sewer Main incl. Sand Bedding, > 3m	m	270	$ 150	$ 40,500	$ 175		$ 47,250
3	1050mm Manholes	each	7	$ 4,500	$ 31,500	$ 7,000		$ 49,000
4	100mm PVC Gravity Sewer Service	m	440	$ 60	$ 26,400	$ 125		$ 55,000
5	100mm PVC Gravity Sewer Service Inspection Chamber	each	10	$ 200	$ 2,000	$ 450		$ 4,500
6	50mm PVC Series 100 Pressure Sewer Main - 2.5m deep	m	200	$ 50	$ 10,000	$ 100		$ 20,000
7	25mm PE Series 100 Pressure Sewer Service - 2.5m deep	m	420	$ 40	$ 16,800	$ 80		$ 33,600
8	25mm Residential Pump Station Package	each	6	$ 4,000	$ 24,000	$ 5,200		$ 31,200
9	Residential Pump Station Electrical Connection	each	6	$ 500	$ 3,000	$ 600		$ 3,600
10	Yard Restoration	each	14	$ 500	$ 7,000	$ 500		$ 7,000
11	Road Restoration	m²	3,500	$ 30	$ 105,000	$ 40		$ 140,000
	SUB-TOTAL				**$ 302,000**			**$ 451,150**
	Engineering and Contingency , 35% (Rounded)				$ 106,000			$ 157,903
	SUB-TOTAL				**$ 408,000**			**$ 609,053**
	SUB AREA 6 - Oval Road							
	200mm PVC Gravity Sewer Main incl. Sand Bedding, < 3m					$ 150	300	$ 45,000
	1050mm Manholes					$ 7,000	2	$ 14,000
	Sanitary Service Connection to Main	each				$ 2,000	9	$ 18,000
	100mm PVC Series 100 Pressure Sewer Main - 2.5m deep					$ 100	100	$ 10,000
	Lift Station					$ 70,000	1	$ 70,000
	Road Restoration					$ 40	1500	$ 60,000
	SUB-TOTAL							**$ 217,000**
	Engineering and Contingency , 35% (Rounded)							$ 75,950
								$ 292,950
				TOTAL	**$ 1,331,500**			**$ 2,275,173**

AREA F - CPP/LANDFILL SEWER (Note: CPP not provided sanitary sewer service)					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total - 2012**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	680	$ 150	$ 102,000
1.0	**Pressure Main**				
	Pressure Main	m	750	$ 150	$ 112,500
3.0	**Services**				
	100 dia.	ea	7	$ 2,000	$ 14,000
4.0	**Manholes**				
	Bases, Frames, Covers	ea	18	$ 2,000	$ 36,000
	1050 Ø Barrels	vm	35	$ 1,000	$ 35,000
5.0	**Restoration**				
	Asphalt Surface	m2	2500	$ 40	$ 100,000
6.0	**Lift Station**	ea	1	$ 100,000	$ 100,000
				Contigency (30%)	$ 149,850
				TOTAL	**$ 649,350**

AREA F - CPP/LANDFILL - WATER

Item	Description	Unit	Estimated Quantity	Unit Price - 2002	Total - 2002	Unit Price - 2012	TOTAL - 2012
1.0	Mobilization & Demobilization	LS	1	$ 8,000	$ 8,000	30000	$ 30,000
							$ -
2.0	Survey Layout	LS	1	$ 6,000	$ 6,000	8000	$ 8,000
							$ -
3.0	Site Preparation Including:						$ -
3.1	Asphalt Removal	LS	1	$ 7,000	$ 7,000	0	$ -
3.2	Locate Existing Infrastructure	LS	1	$ 4,000	$ 4,000	5000	$ 5,000
							$ -
4.0	Watermains c/w Imported Granular Pipe Bedding (all depths)						$ -
4.1	PVC Watermains (Assume no work on private property)						$ -
	.1 200 mm PVC DR 18 Watermain	m	1300	$ 140	$ 182,000	250	$ 325,000
	.2 250 mm PVC DR 18 Watermain	m	1000	$ 160	$ 160,000	275	$ 275,000
	.3 200 mm (Mill main upgrade) - Class 200 pipe	m	100	$ 160	$ 16,000	0	$ -
4.2	Tracer Wire on PVC Pipe						$ -
	.1 #12 AWG Solid Strand Copper Wire	m	2300	$ 1	$ 2,300	5	$ 11,500
	.2 Monitoring Stations @ 300 m Intervals	ea	8	$ 500	$ 4,000	400	$ 3,200
4.4	Chlorination & Disinfection	LS	1	$ 3,000	$ 3,000	(inc in WM price)	
							$ -
5.0	Miscellaneous Valves and Fittings						$ -
5.1	200 F x H Resilient Wedge Gate Valve	ea	3	$ 1,200	$ 3,600	1700	$ 5,100
5.2	250 F x H Resilient Wedge Gate Valve	ea	3	$ 1,400	$ 4,200	1900	$ 5,700
5.2	Class 350 Fittings c/w Assembly						$ -
	.1 200 H X H 22 1/2° Bend	ea	2	$ 500	$ 1,000	1200	$ 2,400
	.2 200 H X H 45° Bend	ea	2	$ 500	$ 1,000	1200	$ 2,400
	.3 250 H X H 22 1/2° Bend	ea	3	$ 600	$ 1,800	1200	$ 3,600
	.4 250 H X H 45° Bend	ea	3	$ 600	$ 1,800	1200	$ 3,600
5.3	End Cap c/w 50 mm FIP Tap	ea	2	$ 900	$ 1,800	1500	$ 3,000
							$ -
6.0	Air Release Valves and Chambers	ea	2	$ 3,300	$ 6,600	5000	$ 10,000
							$ -
7.0	Flush Out Assembly	LS	2	$ 3,000	$ 6,000	3000	
							$ -
8.0	Fitting and Valve Combinations						$ -
8.1	200 mm Tee and 200 GV Combination	ea	1	$ 3,600	$ 3,600	4600	$ 4,600
8.2	250 mm Tee and 250 GV Combination	ea	1	$ 4,200	$ 4,200	5300	$ 5,300
							$ -
9.0	Connection to Existing Main/Reservoir	LS	1	$ 5,000	$ 5,000	6000	$ 6,000
							$ -
10.0	Tie-in to Mill Water System Including Backflow Preventer, Pressure Reducing Valve, Flow Meter and	LS	1	$ 45,000	$ 45,000	0	$ -
							$ -
11.0	Terminal City C71P Fire Hydrants	ea	15	$ 5,100	$ 76,500	6000	$ 90,000
							$ -
12.0	Service Connections						$ -
12.1	Water Services						$ -
	- 25 mm	ea	2	$ 1,500	$ 3,000	3500	$ 7,000
	- 50 mm	ea	2	$ 2,000	$ 4,000	4000	$ 8,000
							$ -
13.0	Restoration and Cleanup						$ -
13.1	Topsoiling and Hydroseeding	LS	1	$ 6,000	$ 6,000	6000	$ 6,000
13.2	Paved Road Repair	m^2	2500	$ 30	$ 75,000	40	$ 100,000
13.3	Gravel Road Repair	m^2	2400	$ 12	$ 28,800	15	$ 36,000
13.4	Boulevard and Driveway Restoration	LS	1	$ 10,000	$ 10,000	12000	$ 12,000
13.5	Mill Restoration (Due to Main Replacement)	LS	1	$ 10,000	$ 10,000	0	$ -
							$ -
14.0	Provisional Items						$ -
14.1	50 mm Styrofoam HI-60 Insulation Over Watermain Sections Less Than 2.2 m Earth Cover	m^2	5	$ 20	$ 100	20	$ 100
14.2	Culverts						$ -
	.1 Removal of Existing Culverts	ea	5	$ 200	$ 1,000	250	$ 1,250
	.2 Reinstallation of Existing Culverts	ea	2	$ 210	$ 420	250	$ 500
	.3 Suppy and Install Culverts	ea	3	$ 540	$ 1,620	600	$ 1,800
14.3	Over Excavation Removal and Disposal of Unsuitable Soils	m^3	100	$ 8	$ 800	12	$ 1,200
14.4	Imported Drain Rock Pipe Bedding	m	100	$ 10	$ 1,000	12	$ 1,200
14.5	Imported Trench Backfill	m^3	400	$ 8	$ 3,000	12	$ 4,800
14.6	50 mm Saddles to Facilitate Testing	ea	2	$ 400	$ 800	600	$ 1,200
	SUB-TOTAL				$ 699,940		$ 980,450
	10% Builders' Lien Holdback				$ 69,994		$ -
	35% Engineering and Contingency				$ 244,979		$ 343,158
	SUB-TOTAL				$ 944,919		**$ 1,323,608**

AREA H - GOOK ROAD / DRAGON LAKE - WATER								
		Item	Unit	Quantity	Unit Price- 2012		Total - 2012	
1.0 General								
	Mobilization/Demobilization		LS	1	$	10,000	$	10,000
2.0 Asphalt Repair								
	Asphalt replacement (watermain trench and services		m^2	4,500	$	40	$	180,000
3.0 Waterworks								
	Watermain C900 PVC CL150							
		150 mm ø	m	80	$	225	$	18,000
		350 mm ø	m	1720	$	325	$	559,000
	Valves and Fittings		m	1	$	50,000	$	50,000
	Service connection (20mm including restoration to		ea	23	$	3,500	$	80,500
	Hydrants		ea	12	$	6,000	$	72,000
	Connection to existing main		LS	1	$	10,000	$	10,000
	SUB-TOTAL						**$**	**979,500**
						Contingency (30%)	$	293,850
						TOTAL	**$**	**1,273,350**

AREA H - GOOK ROAD / DRAGON LAKE - SEWER

	Item	Unit	Quantity	Unit Price- 2012	Total
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	600	$ 150	$ 90,000
	2.5 - 3.5 m depth	m	100	$ 175	$ 17,500
	3.5 - 4.5 m depth	m	100	$ 200	$ 20,000
2.0	**Pressure Main**				
	Pressure Main - 100 mm	m	330	$ 120	$ 39,600
3.0	**Services**				
	100 dia.	ea	23	$ 2,000	$ 46,000
4.0	**Manholes**				
	Bases, Frames, Covers	ea	10	$ 2,000	$ 20,000
	1050 Ø Barrels	vm	12	$ 1,000	$ 12,000
5.0	**Restoration**				
	Asphalt Surface	m^2	2500	$ 27	$ 67,500
Note- it is assumed that the system could be connected to an existing lift station*					
				Contigency (30%)	$ 93,780
				TOTAL	**$ 406,380**

AREA I - NORTHSTAR ROAD - SEWER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	200	$ 150	$ 30,000
2.0	**Services**				
	100 dia.	ea	4	$ 2,000	$ 8,000
3.0	**Manholes**				
	Bases, Frames, Covers	ea	2	$ 2,000	$ 4,000
	1050 Ø Barrels	vm	2	$ 1,000	$ 2,000
4.0	**Restoration**				
	Asphalt Surface	m^2	1000	$ 40	$ 40,000
				Contigency (30%)	$ 25,200
				TOTAL	**$ 109,200**

AREA I - NORTHSTAR ROAD - WATER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total**
1.0	50 mm service	m	50	$ 100	$ 5,000
2.0	Asphalt restoration	m^2	125	$ 40	$ 5,000
				Contingency (30%)	$ 3,000
				TOTAL	**$ 13,000**

AREA J - DRAGON HILL ROAD- WATER

Item	Description	Unit	Estimated Quantity	Unit Price - 2012	Total
1.0 General					
	Mobilization/Demobilization	LS	1	$ 10,000	$ 10,000
2.0 Roadworks					
	Asphalt replacement (watermain trench and services)	m^2	1,200	$ 40	$ 48,000
3.0 Waterworks					
	Watermain C900 PVC CL150				
	200 mm ø	m	475	$ 250	$ 118,750
	Additional cost for crossing of pipeline	LS	1	$ 6,000	$ 6,000
	Trenchless service crossing	m	110	$ 400	$ 44,000
	Service connection (20mm)	ea	6	$ 3,500	$ 21,000
	Hydrants	ea	3	$ 6,000	$ 18,000
	Connection to existing main	LS	1	$ 10,000	$ 10,000
	SUB-TOTAL				**$ 275,750**
				Contingency (30%)	$ 82,725
				TOTAL	**$ 358,475**

AREA K - WEST FRASER ROAD- SEWER

	Item	Unit	Quantity	Unit Price - 2012	Total
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	980	$ 150	$ 147,000
	2.5 - 3.5 m depth	m	840	$ 175	$ 147,000
	3.5 - 4.5 m depth	m	150	$ 200	$ 30,000
	4.5 - 5.5 m depth	m	280	$ 230	$ 64,400
2.0	**Pressure Main**				
	Pressure Main - 100 mm	m	300	$ 120	$ 36,000
3.0	**Services**				
	100 dia.	ea	50	$ 2,000	$ 100,000
4.0	**Manholes**				
	Bases, Frames, Covers	ea	20	$ 2,000	$ 40,000
	1050 Ø Barrels	vm	40	$ 1,000	$ 40,000
6.0	**Restoration**				
	Asphalt Surface	m^2	5575	$ 40	$ 223,000
7.0	**Lift Station**	ea	1	$ 100,000	$ 100,000
				Contigency (30%)	$ 278,220
				TOTAL	**$ 1,205,620**

AREA L - ABBOTT DRIVE - SEWER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	530	$ 150	$ 79,500
2.0	**Services**				
	100 dia.	ea	6	$ 2,000	$ 12,000
3.0	**Manholes**				
	Bases, Frames, Covers	ea	5	$ 2,000	$ 10,000
	1050 Ø Barrels	vm	5	$ 1,000	$ 5,000
4.0	**Restoration**				
	Asphalt Surface	m^2	125	$ 40	$ 5,000
	Gravel Surface	m^2	1200	$ 15	$ 18,000
				Contigency (30%)	$ 33,450
				TOTAL	**$ 162,950**

AREA M - BAKER DRIVE - SEWER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	150	$ 150	$ 22,500
2.0	**Services**				
	100 dia.	ea	2	$ 2,000	$ 4,000
3.0	**Manholes**				
	Bases, Frames, Covers	ea	1	$ 2,000	$ 2,000
	1050 Ø Barrels	vm	1	$ 1,000	$ 1,000
4.0	**Restoration**				
	Asphalt Surface	m^2	500	$ 40	$ 20,000
				Contigency (30%)	$ 14,850
				TOTAL	**$ 64,350**

AREA N - MILLS ROAD - SEWER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	520	$ 150	$ 78,000
2.0	**Services**				
	100 dia.	ea	10	$ 2,000	$ 20,000
3.0	**Manholes**				
	Bases, Frames, Covers	ea	5	$ 2,000	$ 10,000
	1050 Ø Barrels	vm	5	$ 1,000	$ 5,000
4.0	**Restoration**				
	Asphalt Surface	m^2	1500	$ 40	$ 60,000
	Contribute to upsizing Lift Station	LS	1	$ 50,000	$ 50,000
	(Lift station assessment warranted to refine scope of work)				
				Contigency (30%)	$ 66,900
				TOTAL	**$ 289,900**

AREA O - QUESNEL HYDRAULIC ROAD - WATER					
Item	**Description**	**Unit**	**Estimated Quantity**	**Unit Price - 2012**	**Total**
1.0 General					
	Mobilization/Demobilization	LS	1	$ 10,000	$ 10,000
2.0 Roadworks					
	Asphalt replacement (watermain trench and servic	m^2	625	$ 40	$ 25,000
3.0 Waterworks					
	Watermain C900 PVC CL150				
	150 mm ø	m	250	$ 225	$ 56,250
	Service connection (20mm)	ea	6	$ 3,500	$ 21,000
	Hydrants	ea	2	$ 6,000	$ 12,000
	Connection to existing main	LS	1	$ 10,000	$ 10,000
	SUB-TOTAL				**$ 134,250**
				Contingency (30%)	$ 40,275
				TOTAL	**$ 174,525**

AREA P - LARCH AVENUE - SEWER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	100	$ 150	$ 15,000
2.0	**Services**				
	100 dia.	ea	1	$ 2,000	$ 2,000
3.0	**Manholes**				
	Bases, Frames, Covers	ea	1	$ 2,000	$ 2,000
	1050 Ø Barrels	vm	1	$ 1,000	$ 1,000
4.0	**Restoration**				
	Asphalt Surface	m^2	250	$ 40	$ 10,000
				Contigency (30%)	$ 9,000
				TOTAL	**$ 39,000**

AREA Q - JOHNSTON ROAD - SEWER					
	Item	**Unit**	**Quantity**	**Unit Price- 2012**	**Total**
1.0	**200 dia. Sanitary Main**				
	0 - 2.5 m depth	m	300	$ 150	$ 45,000
2.0	**Services**				
	100 dia.	ea	6	$ 2,000	$ 12,000
3.0	**Manholes**				
	Bases, Frames, Covers	ea	3	$ 2,000	$ 6,000
	1050 Ø Barrels	vm	3	$ 1,000	$ 3,000
4.0	**Restoration**				
	Asphalt Surface	m^2	750	$ 40	$ 30,000
				Contigency (30%)	$ 28,800
				TOTAL	**$ 124,800**

AREA Q- JOHNSTON ROAD - WATER					
Item	**Description**	**Unit**	**Estimated Quantity**	**Unit Price - 2012**	**Total**
1.0 General					
	Mobilization/Demobilization	LS	1	$ 5,000	$ 5,000
2.0 Roadworks					
	Asphalt replacement (watermain trench and services)	m^2	375	$ 40	$ 15,000
3.0 Waterworks					
	Watermain C900 PVC CL150				
	150 mm ø	m	150	$ 225	$ 33,750
	Service connection (20mm)	ea	2	$ 3,500	$ 7,000
	Hydrants	ea	1	$ 6,000	$ 6,000
	Connection to existing main	LS	1	$ 10,000	$ 10,000
	SUB-TOTAL				**$ 76,750**
				Contingency (30%)	$ 19,188
				TOTAL	**$ 95,938**

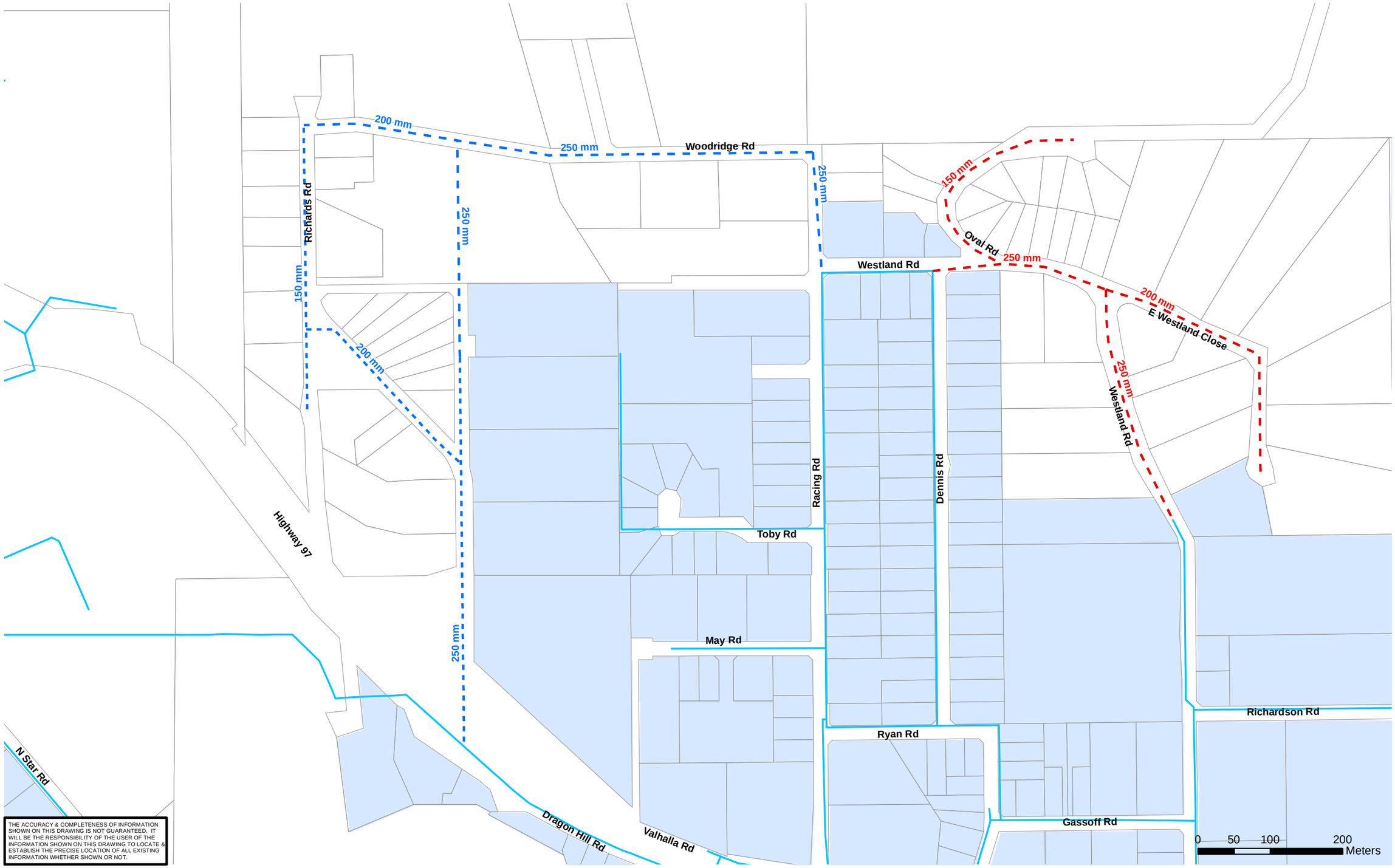
URBAN systems

WATER AND SANITARY SERVICING STUDY

DATE: SEPTEMBER 2012

CITY OF QUESNEL

1:5,000



Legend

- Municipal Boundary
- Parcels Currently Serviced by Water
- Proposed Water Phase 1
- Proposed Water Phase 2
- Existing City Water Mains

EXTENSION OF MUNICIPAL WATER SERVICE

FIGURE 2.0

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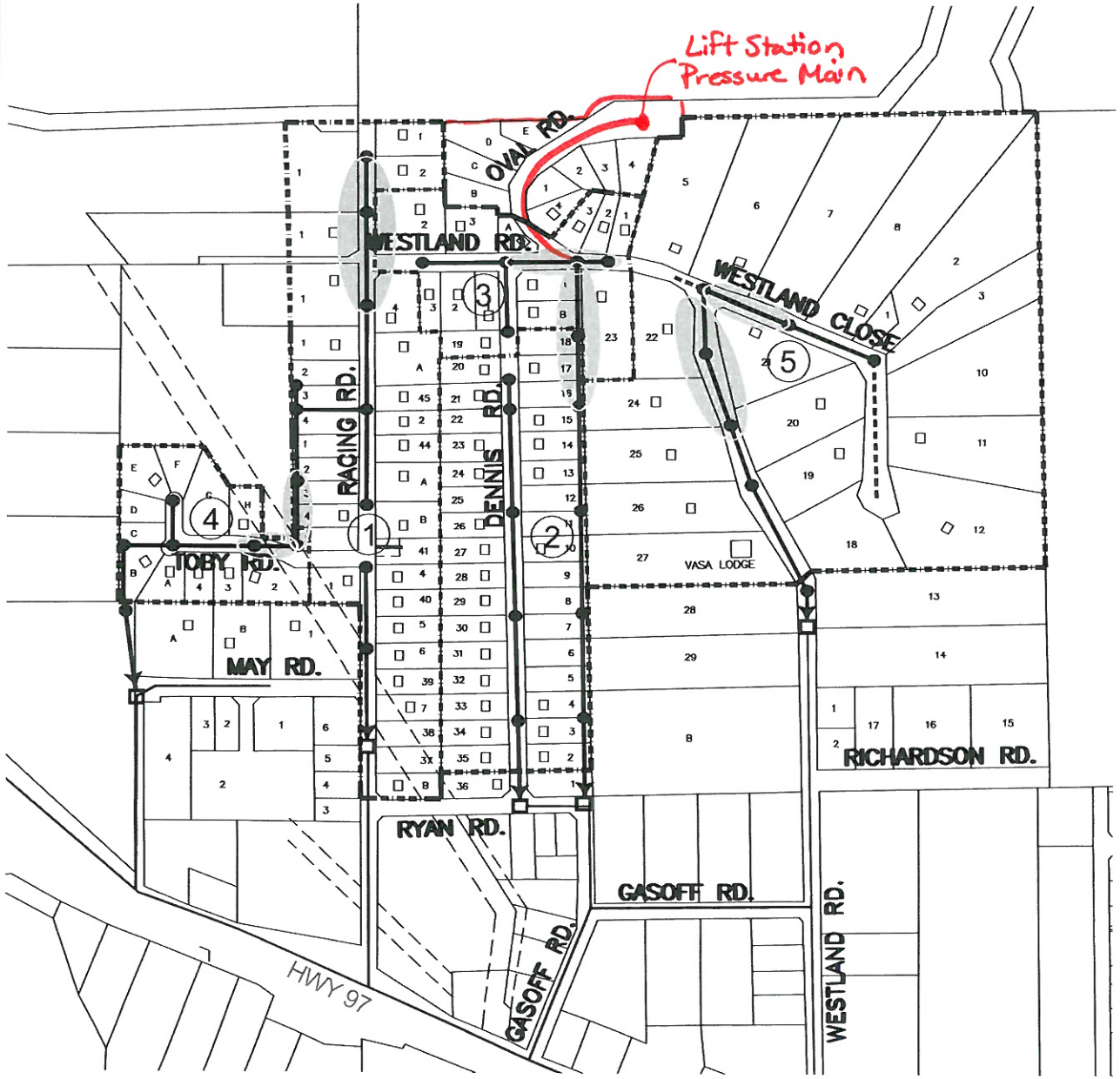


CITY OF QUESNEL

FIGURE 1

SOUTH HILLS SEWER EXTENSION FEASIBILITY STUDY

OPTION 4

Legend:

- Study Area Boundary
- Sub Area
- Gravity Sanitary Main
- Forcemain
- Existing Gravity Sanitary Main
- (4) Sub Area Number
- Proposed Manhole
- Tie Into Existing Gravity System
- San. Main >3m

0 400

Meters

URBAN SYSTEMS.

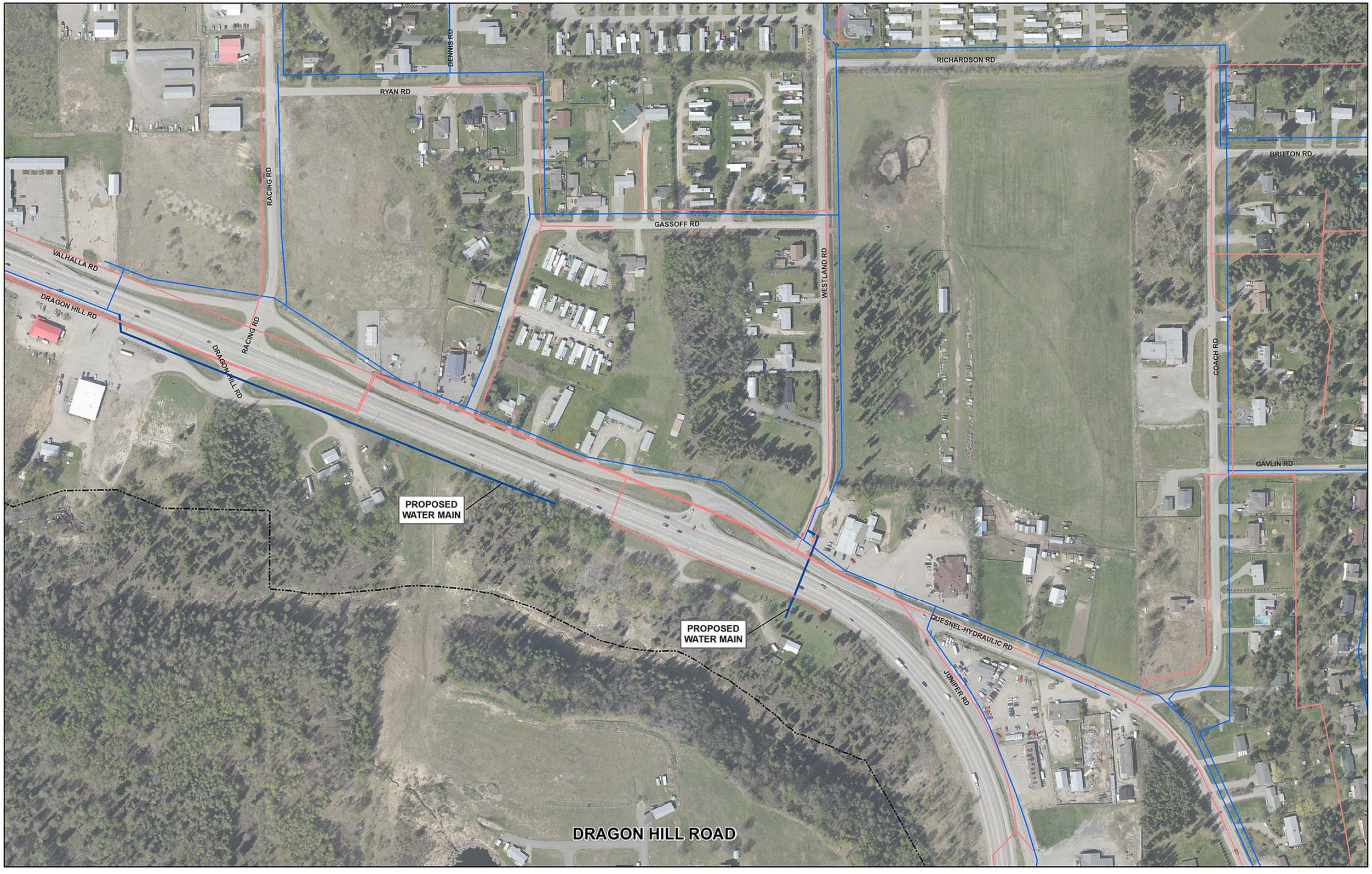
Engineering · Planning · Landscape Architecture · Local Government

RICHARDS/WOODRIDGE ROAD


CARSON PIT RD
PROPOSED SANITARY MAIN
SWORD AVE
WELL
THIS AREA SERVED BY INDEPENDENT CITY WELL AND WATER SYSTEM
NORTH STAR RD
CPP/LANDFILL SEWER

PHILLIPS RD
THOMPSON RD
SANDERSON RD
FIEGE RD
REDDEN RD
TATCHELL RD
LOIS LANE RD
POWELL RD
QUESNEL HYDRAULIC RD
REDWING RD
LARCH AVE
GOOK RD
GOOK RD
TO CITY SEWER SYSTEM
PROPOSED SANITARY MAIN
WEE RD
TO CRD SEWER SYSTEM
PROPOSED SANITARY MAIN
Dragon Lake
GOOK ROAD/DRAGON LAKE

NORMAN ST
NASON ST
NETTERFIELD ST
NAGRA AVE
NOVAK ST
NICKEL RIDGE AVE
CAMPUS WAY
NORTH STAR RD
PROPOSED WATER MAIN
NADEAU ST
LOWE ST
LAMBERT ST
JOHNSTON AVE
LEONARD ST
LAWLOR DR
PROPOSED SANITARY MAIN
NORTHSTAR ROAD


RYAN RD
DENNIS RD
RACING RD
GASSOFF RD
WESTLAND RD
RICHARDSON RD
BRITTON RD
COACH RD
GAVLIN RD
VALHALLA RD
DRAGON HILL RD
RACING RD
DRAGON HILL RD
PROPOSED WATER MAIN
PROPOSED WATER MAIN
QUESNEL-HYDRAULIC RD
JUNIPER RD
DRAGON HILL ROAD


PROPOSED
SANITARY MAIN
WEST FRASER ROAD
Fraser River
ALLISON AVE
AVERY AVE
AVISON AVE
ANDERSON DR
WILLIS ST
WARDEN ST
DOHERTY DR
ROODIE AVE
WINDER ST
WILKINSON ST
WADE AVE
RITSON AVE
ROOPE DR
ROLPH ST
RITCHIE AVE
ROBERTSON AVE
REINHARDT ST
HYBERG ST
MALCOLM ST
ALLARD ST
ADAM ST
CARRY ST
JOHNSTON AVE
TORSTON AVE
MOFFAT AVE
GARDNER ST
KIVI RD
ANTLER REL
OLD FRASER RD


FINDLAY RD
DAWSON ST
PROPOSED
SANITARY MAIN
ABBOTT DR
ABBOTT DRIVE


PROPOSED SANITARY MAIN
PROPOSED SANITARY MAIN
TWAN AVE
TWAN PL
FINGLEY DR
BAKER DR
HEALY ST
HEALY ST
FUNN ST
NORTHERN AVE
Fraser River
Baker Creek
TAWCETT ST
EDWINS ST
FULLER AVE
BAKER DRIVE SEWER


PROPOSED SANITARY MAIN
TO LIFT STATION
DYKE RD
MILLS RD
NORTH FRASER DR
TITUS RD
MILLS ROAD
Fraser River